# ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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### Discrimination of Positive and Negative Electricity.

In conductors of high specific resistance the mean of the potential value at the ends lies the nearer to the negative electrode the greater the resistance. For accumulations of equal quantities of electricity on equal conductors, the potential measured by the electrometer is greater for the positive charge than for the negative charge; this does not depend on unequal losses of electricity to the air, but on unsymmetrical arrangement of the potential surfaces for positive and negative electricity. The unequal striking distance between differently formed electrodes gives a proof that the losses of electricity do not postulate this difference. The rotation of the electric orrery in the direction of the positive electric stream lines shows that the motions of the air at the positive electrode are of a different nature from those at the negative, and the dissymmetry of the equipotential lines follows from the dissimilar forms of the positive and negative brush discharge.

### Photometer for Electric Light.

The photometer depends on the principle that the two surfaces to be compared, each of which is at a different distance from the source of light, are illuminated, and that so much light from the standard flame is allowed to fall on to the more distant and therefore less brightly illuminated surface as will bring its brightness up to that of the nearer surface.

### Inductionless Coils for Electro-Magnets.

Between the several layers of wire were interposed layers of lead, copper, or tinfoil, which formed closed circuits; or layers of bare copper wire were wound on between the insulated wires. The frame on which the wires were wound was also made of thick copper sheet, forming a closed circuit. The induction currents set up on opening the circuit were thereby much diminished.

### Thermo-Electric Experiments.

An irregular structure can be imparted to a piece of zinc, tin, iron, or copper by rolling. If the plate thus formed is heated at the center, and two points, B and C, are connected with a galvanometer, C being in the direction of the rolling from the heated point, and B at right angles to it, the current flows from B to C in the outer circuit. The thermo-electromotive force increases if the rolling is repeated in the same direction.

### Influence of Magnetism on the Polarization of Dielectrics.

According to Rowland, Hall's phenomenon and the electro-magnetic rotation of the polarization plane must depend on the same principle, and hence Hall's phenomenon should occur in dielectrics, and magnetism must influence their dielectric polarization. Lorentz, on the other hand, has shown that Hall's phenomenon does not occur in dielectrics.

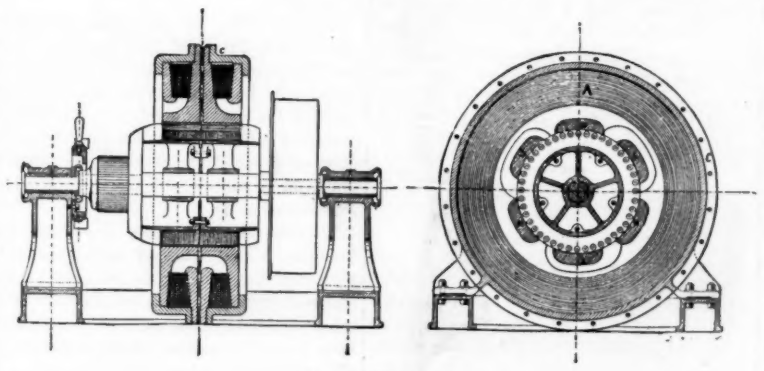
The author's experiment, made with plates of sulphur and with two parallel copper plates between which was the dielectric, these plates being placed between the poles of a powerful electro-magnet, all showed that magnetism has no effect on the dielectric, as has been noticed by Hall himself.

### Use of an Auxiliary Battery for Telephony.

A condenser is used, consisting of a middle plate *A*, connected to the secondary circuit, and two outer ones *B* and *C*, *B* being connected directly to earth, and *C* through a Zamboni's dry pile. The two outer plates are provided with hearing-tubes. With this arrangement only the primary note corresponding to the period of the microphone is heard, and not the higher octaves, as is the case in other electric and magnetic telephones.

### On the Temporary Appearance of Electric Polarization.

The battery current was periodically passed through dilute sulphuric acid, and in the intervals the polarization current was passed through a shunt. A portion of the current was also shunted through a galvanometer. On closing the circuit, the current in the first moment increases exceedingly quickly to a maximum, which probably corresponds to the current without polarization, and then sinks with decreasing rapidity to a constant value.



FIGURES 3 AND 4.

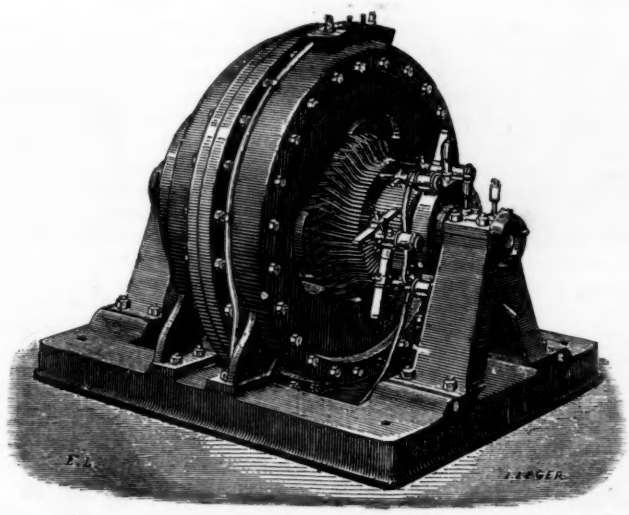


FIGURE 5.

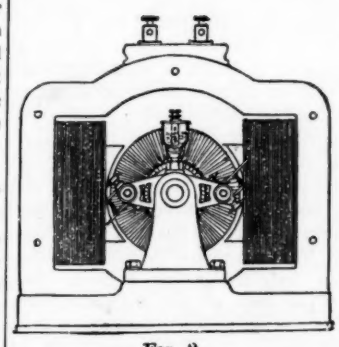


FIG. 2.

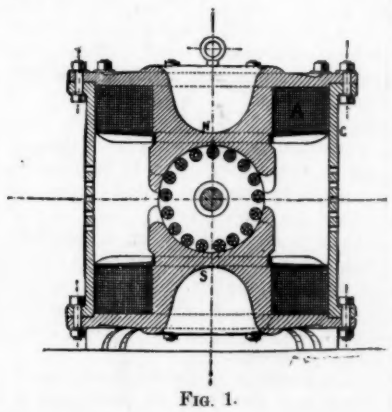


FIG. 1.

IRON-CLAD DYNAMOS.

### Iron-Clad Dynamos.

Although numerous types of dynamos are now in the market, the difference between them is principally one of detail. The magnets may be a little heavier in one type, as compared with another, or the armature may be wound on the Hefner Alteneck principle, instead of on that of Gramme; or the core of the armature may project between the wires, instead of being made flush; but in the general design we have practically the same combinations of field magnets and armature repeated over and over again. In the types of field magnets commonly employed, there is the defect that a certain amount of the magnetism created by the exciting coils is dissipated through the space surrounding the machine, and is thus lost for its legitimate purpose. Now that the question of magnetic leakage is receiving some attention from the designers of dynamo machines, it is but natural that, in casting about for new shapes and combinations, they should hit upon iron-clad types, and thus, perhaps unconsciously, revive designs which date back to the early days of the dynamo, when electricians were not guided by any clear understanding of the principles involved, but worked, so to speak, according to engineering instinct. A good modern example of an iron-clad machine is the dynamo of Mr. Kennedy, which we illustrated some time ago, when describing the electric light installation at the Edinburgh Exhibition. In that machine, poles of alternate sign were placed opposite the two faces of a disk armature in such a way that all the poles on one face were north, and all the poles on the other south, but not immediately facing each other. If they were arranged to face each other, the lines would simply flow across the disk, and cut wires of the same coil in opposite directions, thus producing no effect; but by placing the poles at intermediate positions the lines flow obliquely through the disk, and the usual effect is produced. It is a disadvantage, inseparable from this design, that the polar surface is only half as great as would be the case in an ordinary disk machine, where each pole surrounds the disk on both sides; and in consequence of this decrease in polar area, the magnetic resistance of the circuit is considerably increased, thus necessitating more exciting power, and, to a certain extent, counteracting the very object for which the iron clad arrangement is intended, viz., to decrease leakage, and, therefore, reduce the exciting power necessary to produce a given useful field. To make the iron-clad type successful it is, therefore, necessary to bring the iron of the armature very close to the magnet poles, and this points naturally to the adoption of Pacinotti projections. But the close proximity of these to the polar faces is liable to cause heating, and it may be that, for these reasons, iron-clad dynamos have not, hitherto, been so successful as might be anticipated at the first glance. The invention of the iron clad dynamo dates back at least five years, and probably more (one of Wenström's patents is dated 1882), and the fact that during this long time the type has failed to come into favor, seems to indicate that there are drawbacks which prevent the practical application of an otherwise theoretically excellent

design. The iron-clad principle has, however been successful in Professor Forbes' non-polar dynamo, and also in Mr. Kennedy's latest four-pole dynamo with only two exciting coils. These two machines may, at the present moment, be considered as fairly representing the usual practice in England, as far as the system of surrounding the exciting coils completely with iron is concerned, and it is interesting to compare with these examples, what is now being done abroad in the same direction, and especially as regards the dynamos of Mr. Wenström, of Sweden, who, as has already been pointed out, was one of the first, if not the very first, to adopt the iron clad design. The drawings and figures we give herewith are reproduced from our contemporary, the *Centralblatt für Elektrotechnik*. It seems that Mr. Wenström has from the first recognized the necessity of reducing the resistance of the air space, and has adopted the Pacinotti form of core; but, in order to avoid the heating effect by the surging of lines past the polar surfaces, which is inevitable with a small clearance and detached projections, he has widened out the projections at their extremities, so as to produce a nearly smooth core, the wires being laid in circular channels, with a slot at the top of each, which is just wide enough to pass the wire through during the process of winding. This arrangement is clearly shown in our illustration (Fig. 1), which represents a two-pole iron clad dynamo, with drum armature wound on the Hefner Alteneck principle. *A* are the two exciting coils, *N* and *S* the field magnet poles, and *C* the outer circular casing serving to complete the magnetic circuit between one pole and the other, and at the same time completely inclosing the exciting coils. It will be noticed that the pole pieces appear in our section somewhat unsymmetrical, the horn of the south pole being extended further on the right than on the left, whilst the horn of the north pole is extended further on the left. This is due to the edges not being straight lines and parallel to the axis, but broken lines, so as to avoid the sudden tearing away of the whole length of the projections from the edge of the pole pieces. Fig. 2 is an outline sketch of a dynamo designed by Herr Lahmeyer, and made in Germany This machine is similar in design to the well-known Hochhausen arc light dynamo, but the magnets are placed horizontally, and the yokes are much more massive, whilst the armature is more accessible than that of Wenström's two-pole machine, where the yoke is shaped as a closed cylinder. Some of our readers will perhaps remember that at the Vienna Exhibition, in 1883, there were shown some small "Gerard" dynamos, in arrangement absolutely identical with Lahmeyer's, but having rather longer magnets and less massive yokes. Figs 3 and 4 show a different arrangement of Wenström's machine, adapted to a six-pole dynamo, the armature being wound on a modification of the Hefner Altenеck principle. The section in Fig. 3 is taken through one of the Pacinotti teeth on the armature core below the spindle, and through one of the grooves containing bundles of wires forming the winding above the spindle; but the wires on either end of the armature have, in order to avoid useless complication, not been continued in our drawing. *A A* are again the exciting coils, inclosed by a double central web and two external iron rings. The central web and the iron rings are prolonged radially inwards at intervals, so as to form the six poles, which must thus evidently be of alternate polarity. It seems doubtful whether the arrangement here shown is a very good one, since a strong leakage is likely to take place between the poles connected to the double central web and the intermediate portions of the external rings on the one hand, and between the poles connected to the external rings and intermediate portions of the central web on the other hand. With such an arrangement, a very small distance between the iron of the armature and the field magnets is an absolute necessity, and, therefore, Mr. Wenström has also in this case adopted the plan of closing up the grooves by widening the Pacinotti projections over the wire, in order to run with the least possible clearance without undue heating. Fig. 5 shows this machine in perspective view. The following figures are amongst those given with regard to the construction and performance of a machine designed to give 190 amperes at a terminal pressure of 110 volts when driven at 460 revolutions per minute :

| | |
|---|---|
| Diameter of wire on field magnet | 102 mils. |
| Total length of wire on field magnet | 4,500 yds. |
| Resistance of wire on field magnet, warm | 15.5 ohms. |
| Diameter of wire on armature | 141 mils. |
| Total length of wire on armature | 484 yds. |
| Resistance of armature | .02 ohm. |
| Number of sections in commutator | 90 |
| Number of grooves in armature | 45 |
| Number of wires in each groove | 16 |
| Total number of wires counted around armature | 720 |

From these figures it follows that the current through the magnetizing coils *A*, which are placed as a shunt, is 7.1 amperes, and the energy required 781 watts, whilst the loss of pressure due to the internal resistance of the armature is 3.94 volts, and the loss of energy 775 watts. The useful external electrical work is 20,000 watts, so that the field absorbs about 3¾ and the armature a little over 3⅞ per cent. of the available energy. This must be considered a very satisfactory result, though not better than that obtained with the best English dynamos having single horseshoe magnets of the usual type. The weight of this machine is given as 44 cwt., which is at the rather large rate of 1.57 cwt. per horse power output.—*Industries.*

## Electrical Engineering.

By George B. Prescott, Jr.

The applications of electricity are daily becoming more varied, and the remarkable growth of electrical industries is a subject of interest to most observing people. It is difficult to realize that only ten years ago the commercial applications of electricity with which the public was familiar, might have been summed up in the electric telegraph and its subsidiary systems, and yet such is the fact. Nevertheless the money value of the capital invested in electrical enterprises at the present time, is probably only exceeded, in any single industry, by the amount invested in steam transportation and in municipal gas lighting.

This rapid extension of the electrical arts is not largely due, however, to the discovery of new principles nor to inventions of a revolutionary character, but chiefly to the perfecting of details, and practical modifications in old systems operated by well-known methods. Perhaps this statement may be satisfactorily illustrated by a brief mention of the more important arts in which, during the past ten years, electricity has either entered as a rival of other forces of nature, or rapidly increased its dominion over them.

The first and probably most important invention of the past decade was that of the speaking telephone. The time was ripe for its introduction, and it was received with fewer objections than any other considerable innovation of modern times. Within a few years after, there was hardly a town in the country without its "exchange," and to-day the telephone is almost exclusively used for communication between places not far apart, and is already beginning to supplant the telegraph in what has hitherto been considered its special field. Long distance telephony is practically an accomplished fact, and is one of the progressive features of the past two years, communication upon a commercial basis having been established during this time between New York, Boston, and other centers.

The invention of the telephone was followed very closely by the production of a practical incandescent, or glow, lamp. The qualities of the glow lamps were immediately recognized as being far superior to those of any other artificial illuminant, particularly the steadiness and intensity of its light. Even more was expected from the new light than it was destined to perform for some time to come. The arc lamp had been in use to a limited extent, chiefly for street lighting, to which it is admirably adapted, but at the present time each form of the electric lamp is rapidly encroaching on the domain of gas, both for open and interior lighting. The electric light is, in fact, already so common in public places, that it no longer elicits expressions of wonder, although it is still spoken of as "the light of the future."

Everybody is more or less familiar with the electric fire alarm telegraph, for who stops nowadays to ask how the electric bells are rung, and what would be thought of a city which had not such a system? This was hardly the condition of affairs ten years ago, however, and the same sort of progress may be noted in the extension of the district, or messenger telegraph systems.

Although electric burglar alarms have long been operated, it is only in recent times that incorporated companies with central office systems, supplying watchmen and police assistance in connection therewith, could be found in all large cities. Again, no one will claim that electric clocks are novel, and yet the distribution of standard time from central stations by means of electricity, is but now assuming the extensive proportions which indicate the magnitude of its field of operation.

Galvanoplasty, or the art of electro plating, was practiced to a considerable extent ten years ago, and has since continued to multiply its applications until it has now reached the proportions of a considerable industry; while electro-metallurgy—the reduction of metals from their ores—has recently been successfully worked on a large commercial scale.

Electric railway signals were long since brought to that state of perfection which permitted the running of trains at a speed, and with a frequency which they could not otherwise have attained. Nevertheless a very recent invention, which makes it possible for signal stations to continuously communicate with moving trains, and for trains in motion to exchange signals with one another, promises to materially modify the old methods, and to reduce the danger from collisions to a minimum.

The storage of electricity, or more properly speaking, the accumulation of energy in a shape in which it may be utilized as required, in the form of an electric current, is an accomplished fact; and considerable capital is already invested in the manufacture of accumulators, or secondary batteries, which have an extensive although special department of usefulness. Practical methods of electric smelting and of electric welding have also been devised, each having its peculiar advantages, and destined, no doubt, to occupy an important place in the industrial world.

The diversity of the nature of the applications of electricity is well illustrated by some of the more recent inventions, among which may be mentioned tele-barometers, tele-thermometers, tele-manometers, and tele-hydrobarometers, which respectively record at distant points air pressure, heat, steam pressure, and water stages. Numerous other applications of electricity to the industrial arts have been perfected, and are now performing their service to mankind; but only one other, which is, perhaps, the most important of all from an industrial point of view, need be mentioned here.

The transmission of power by means of the electric current has for years been a favorite scheme with electricians, and much labor and ingenuity have been expended in attempts to carry out the idea in a practical form. The perfection of the modern dynamo-electric machine—which converts ninety-seven per cent. of the mechanical power applied to its pulley into electricity—has solved the problem of economically generating current, and at last makes the transmission of power to a distance, on a commercial scale, possible. Furthermore, the dynamo has only to be slightly modified, in order to be transformed into an almost perfect motor, and the necessary modifications relate simply to a means of insuring uniform speed under varying loads, or amount of work performed. Many methods of accomplishing this result have already been announced; and the applications of electric motors to remunerative commercial work are being rapidly increased. Already a large number of elevators, printing presses, and small machine shops in the larger cities are driven by electric motors, which are supplied with current from local electric lighting stations; and some half-dozen electric street railways are now in practical operation.

So far the various electrical enterprises have been mentioned only with reference to the amount of capital invested in the operation of certain commercial systems; but it would be a serious omission not to refer to the magnitude of the manufacturing interests directly involved in the production of the apparatus used therein. With the possible exception of the lighting corporations, few of the companies operating electrical systems manufacture the instruments which they use; and the amount of electrical apparatus produced by the numerous electric manufacturing concerns throughout the country each year is enormous. The consumption of iron and copper wire for electrical purposes alone, is almost fabulous, and even of German silver wire quite a large amount is used. The covering of wire with various insulating compounds, and the making of the same into cables for aerial, subterranean, and submarine use, is also a large industry; and as the reliability of insulated wire depends in a great measure upon its being accurately tested for its electrical properties, expert electricians are employed in all such establishments. The manufacture of electrical testing instruments—some of which exceed in delicacy any other physical apparatus—is also an extensive business, and the most skillful electricians and mechanicians are occupied in their designing and making.

Attention has already been directed to the small part played by new principles, or by entirely novel applications of electricity, in the electrical progress of the decade. For example, the principles employed in the telephone have been well known in that particular combination for more than thirty years, and every old text-book of physics will tell us that the arc lamp dates back to Sir Humphrey Davy. Incandescent lamps have been patented at intervals since 1845, and, strangest of all, the electric motor is even older than the dynamo.

Such in brief is the field covered by electricity to-day. Much of the credit for perfecting the details of the electrical systems as a whole, is due to the skillful men who are to a large extent operating them now, and who have grown up with the systems. Ten years ago telegraph engineering covered every branch of applied electricity, and the title of telegraph engineer, or electrician, was thought to be sufficiently comprehensive. With the evolution of the dynamo electric machine and the consequent production of electricity through the medium of mechanical power, the broader profession of electrical engineering has sprung into existence.

This state of affairs, viewed in connection with the fact that industrial electricity appears to be only in its infancy, naturally attracts young men who desire to follow a mechanical occupation; and the electrician's calling certainly has the appearance of offering them a larger field and better opportunities for commercial advancement than the older, and, apparently, more overcrowded professions.

Skillful men are of course required in every branch of electrical work—quite as much in the manufacturing as in the operating departments. The diversity of the electrical business, however, renders it advisable for an electrician to make a specialty of one or more branches of applied electricity, although a general knowledge of all is usually essential for thoroughly good work. Some of the applications of electricity require little or no mechanical knowledge for their successful operation. The principal mechanical branches of electrical engineering are the designing of apparatus, the erecting of poles and wires, the laying of underground and ocean cables, the planning and construction of stations for the distribution of light and power, and the selection and placing of

engines and boilers. Electrical conditions obviously must be taken into account in planning and carrying out any of this work.

Electrical engineering is to a great extent an empirical profession. It is eminently practical in its nature, and, excepting the telegraph branch, so new that it may almost be said there are no school-bred electricians in the ranks. They are educated men, but their education has been, for the most part, the slow and practical sort of the workshop and the laboratory. Those who were well fortified with a general scientific education handicapped the others, but only in the matter of time, where equal inherent ability existed, for it is a well-known fact that the prominent electricians and inventors of the day are self-educated men.

A number of educational institutions have lately added a course in electrical engineering to their curriculum, in which a general education in the physical sciences is supplemented by special instruction in electrical laws and principles, and by such illustrations of their practical applications, as the laboratory equipments of the colleges afford. Among these institutions may be mentioned Cornell University, Stevens Institute of Technology, and the Massachusetts Institute of Technology. In such schools a young man can master in three or four years, what it would take ten years of so called self-teaching to acquire; and yet the experimental knowledge imparted by practical commercial work can be neither forestalled nor dispensed with as a preliminary to remunerative employment.

As to the question, How can a young man best educate himself for an electrical engineer, who shall say? Helmholtz began the study of physiology with the intention of following it as a profession, and had made but little progress in his specialty before he discoveredthat, as a preliminary to its successful prosecution, a considerable knowledge of physics was necessary. So he set to work to learn what was known of natural phenomena and their laws, only to be confronted at the outset of his labors by the need of a better knowledge of mathematics than he then possessed. But he was not to be easily discouraged, so for the time being he laid aside physics as he had laid aside physiology, and devoted himself to the study of mathematics. The world knows the result of his perseverance, and although his achievements are extraordinary, his experience leading up to them is common. With the study of electricity comes the same sort of experience, for a knowledge of chemistry, physics, mathematics, and mechanics is necessary for its perfect comprehension, and final practical utilization.

If a young man is endowed with exceptional ability and genius, which does not, however, manifest itself by a marked preference for a special line of work, the choice of a vocation is, so far as his professional or commercial success goes, a matter of indifference, or at least of chance. To the average man electrical engineering undoubtedly offers as good an opportunity for earning a livelihood as any other technical business. It is a mistake, however, to suppose that positions are vacant for the want of men, and only those who are intelligent and industrious will find it easy to make more than a start; and even those who are proficient in the required theoretical knowledge will usually have to be contented, barring exceptional influence, with a humble beginning.—*The Chatauquan.*

—— Several representatives of the Thomson-Houston Company, of Lynn, were in Millbury, Mass., last week, preparing to give an exhibition of the electric lights. They have set up a three light machine a the Millbury machine shop, and as soon as the wires can be put in position will start the lights at central points in town. The effect of this exhibition is, of course, to introduce the lights there, and, if possible, to secure a contract to light the town. There is also another company figuring for a contract to light the town with oil, using the old lanterns, with patent reflectors. The citizens will very probably take the electric light instead.

Written for the ELECTRICAL REVIEW.

## Some Hints on Magnetism.

BY FOREE BAIN.

One of the most familiar phrases that greets the ear when talking of electricity is, "Electricity is only in its infancy."

Do we ever hear any one say that magnetism is only in its infancy?

Have we ever heard any fanatical enthusiast exclaim that there is "nothing impossible with magnetism"? Substitute the word electricity for magnetism, and the sentence becomes a "chestnut."

How quickly the "electric telegraph" usurped the more appropriate appellation, the "magnetic telegraph." Probably very many of a younger generation would hardly comprehend the meaning were an "old timer" to speak of the telegraph as the magnetic telegraph. Once it was the electric-magnetic, but now electricity does not divide the honors in any way, but keeps all. Electricity without the aid of the electro-magnet was a complete and dismal failure for telegraphic purposes.

I for one am ready to call a halt. While there has been so much thought and time given to the study of electricity, I cannot see why magnetism has been so shamefully neglected. Since the discovery of electro-magnetism by Oersted in 1819, very little advance has been made in a theoretical knowledge or practical application of such knowledge. Every capable electrician is familiar with the absolute and practical units of electrical measurement. Various galvanometers, voltmeters, ammeters, wattmeters, etc., have been devised for measuring the properties of the electric current. Can any one direct me to an instrument for measuring magnetism? There is no such instrument in the market, and if I had such an instrument how could I measure and express the magnetic units, since there is no name for them? To investigate the laws and properties of magnetism understandingly, the unit of resistance is as essential as the ohm; the unit of potential as necessary as the volt; the unit of strength as important as the ampere, and the units of quantity and capacity as desirable as the coulomb and farad.

The only means of measuring magnetism at present is by comparison—the strength of an electro-magnet can only be approximated by calculation from an electrical standpoint, which leaves out of the question the material and condition of the core of which the electro magnet is composed. DuMoncel, Jamin and Deprez have given some excellent ideas in regard to the practical construction and proportions of electro-magnets, but their results have been wholy arrived at by experiment, and have not been demonstrated by mathematical calculation. We are all familiar with the error made in the proportions of the field magnets of the dynamo of one of the largest and most prosperous electric light companies extant. Compare one of its short magnet machines of to-day with one of the older forms; observe the difference in length and material, and reflect upon the necessity of a more thorough knowledge of this important branch of electro-kinetics, magnetism.

I can cite a hundred experiments which show that magnetism requires a conductor; that this conductor offers a resistance to its passage. Why not have a unit of resistance and a means of measuring it? I can show that magnetism is limited by the capacity of the conductor—why have we not a unit of capacity and a means of measuring that capacity? Density of magnetism should be arrived at in a similar way, and so should residuary charge, condensed and consequent magnetism. And the element of time in electro-magnetism, too, is a more important factor than is usually considered, if considered at all. In some experiments the persistence of magnetism has proven to be the vital element of success, while in others it has been as the death knell to hope; and yet by a knowledge of the practical construction of electro-magnets, this persistence may be varied at will. I say a knowledge—I mean such knowledge as is gained by patient labor and experiment, which is an expensive way of acquiring knowledge, but the same results might be attained far easier by mathematical calculation, if there were only a starting point—if we possessed certain definite units of measurement expressing the various qualities of this most subtle of all forces.

I do not assert that magnetism cannot be measured, or that its strength cannot be calculated; but I do say that it is only done comparatively. It is a very easy task to construct instruments which will accurately measure in practical units the various characteristics of permanent or electro-magnets—in fact, the writer has such an instrument, which he has constructed and used for several years. Its readings are comparative, but well understood by its possessor.

It detects if there exists, any consequent points in a field magnet; it indicates the degree of saturation of the magnet, and shows the direction of the lines of force.

As magnetism is the kinetic force of most all electrical apparatus, in order to produce the best effects through this motor agent, is it not well to give it some thought and study?

A magnet, either electro or permanent, is a simple thing of itself. Very possibly its very simplicity may account for its being so utterly ignored. An iron bar, having a bit of wire wound around it, with a current of electricity passing through the wire, will become magnetic, and this is the way electro-magnets are too often constructed, without any attention to detail. The length, size, shape, or mass, at the core, is not properly considered; the position or location of the coil, the proportionate length or thickness, the manner of connecting the coils in circuit, seem hardly to be matters of particular consequence. Latterly, we have heard something said about the number of ampere turns to produce certain effects; but this is an electric, not a magnetic expression. I would advise that more attention be given to the study of magnetism. To the young and diligent student I will promise that he will find that there are "more strange things in magnetism, Horatio, than are dreamt of in your philosophy."

NEW MEDICAL BATTERY.

## Mean Intensity of the Magnetic Field of Dynamos in Absolute Measure.

The intensity of the field depends on the magnetizing force, which is proportional to the strength of the current multiplied by the number of turns of wire, and on the magnetic resistance. The intensity of the field of a dynamo may be determined by measuring the current produced when a coil is rotated once in the field. The value thus obtained is, however, not that which exists when the dynamo is at work, for the important action of the helix on the field, which may amount to as much as 25 per cent., is not taken into account.

Experiments were made on a Schuckert dynamo of the type $EL_1$, the electro-magnets being separately excited, and the difference of potential at the brushes being measured on a torsion galvanometer. Knowing the length of the wire on the armature ($l$), the circumferential speed of the latter ($v$), both in centimeters, and the E.M.F. in volts, the intensity of the field is found from the equation

$$F = \frac{E \times 10^8}{l\,v}.$$

Seventeen measurements were made with exciting currents varying from 1 ampere to 20 amperes, the E.M.F. varying from 21 to 88.7 volts, when it was found that the intensity of the field varied from 90 to 400 units. The values calculated from the above formula agreed with the observed values within 3 per cent.

The intensity of the magnetic field may also be expressed by the formula

$$F = \frac{G \,.\, \mu \,.\, n\,I}{1 + a\,n\,I},$$

where $n\,I$ is the number of ampere turns, G a constant depending on the shape and form of the electro magnets, $a$ is a constant depending on the quality of the iron, and $\mu$ the coefficient of magnetic permeability. By combining the constant in the above formula, it becomes

$$F = \frac{a\,I}{1 + b\,I},$$

which is the form given by Frölich.

## New Electro-Medical Apparatus.

The leading features of the "Vesta" medical battery, which is the invention of a pioneer and thorough student in the electrical field, consists in the fact that the cover of the cell is a solid piece of carbon in the form of a stopple, cemented acid tight in a wide-mouthed, heavy, flint glass jar, and that the carbon element is a part of the cover itself, and consists of four distinct legs or pencils of carbon extending from the cover down into the liquid.

The zinc element consists of a pencil of that metal which passes through an insulated hole in the center of the carbon cover.

When it is understood that the connectors make their contact with the elements by resting directly upon the carbon cover and the zinc pencil respectively, it is at once seen that all metal parts in connection with the cell are dispensed with, and that there is nothing left to corrode.

Those who are most familiar with the defects in acid medical batteries will best understand this advantage. The carbon cover is never removed, the cell being discharged and refilled through the central hole that accommodates the zinc.

Also accompanying the "Vesta" is a soft rubber stopple, to be inserted in the central hole of the cell cover when desired, making the whole battery for carrying about, as safe and portable as a bottle.

While this battery is adapted for the familiar electropoigne or "red fluid," Messrs. Greeley & Co., the manufacturers, supply a dry compound of pulverized chrome sulphuric acid, known as "Seko," packed in bottles, with printed directions. The advantages of "Seko" are portability, cleanliness, power and durability. The battery is illustrated on this page.

—— The East River Electric Light Company of this city, has been granted permission by the Board of Aldermen to lay wires in all the streets of the city, subject to the restrictions of the Subway Commissioners.

ELECTRICAL REVIEW

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NEW YORK, APRIL 9, 1887.

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The American Bell Telephone Company has had a prosperous year, during the past twelve months. A synopsis of the annual report appears on another page.

In another portion of the REVIEW an article on magnetism, by Mr. Forèe Bain, shows conclusively how thoroughly this mode of motion has been neglected, and how rich a field is open to the investigator.

The Edison-Gilliland-Smith and the Phelps induction systems for telegraphing to and from moving railway trains have consolidated. The offices of the company will be at 13 Park Row, and it will be known as the Consolidated Railway Telegraph Company.

The interesting report of Lieut. John Millis, U. S. N., on the adaptation of the electric light for light-house purposes, is published in full on another page. Lieut. Millis has had charge of the experiments made by the United States Light-House Board, and his report covers the conclusions reached after much careful and intelligent work.

Mr. Fred A. Gilbert, president of the Boston Electric Light Company, has added another to his already numerous and important electrical family. The purchase of the Merchants Electric Light Company is given in our Boston letter, where, by the way, it was predicted several weeks ago. Mr. Gilbert, as president of the consolidated companies, is the executive head of one of the greatest organizations in the electric lighting field, and one that gives promise of most rapid development. The exclusive control of electric lighting in the valuable territory of the city of Boston is vested in able and experienced hands.

## *CARBON COMPANIES CONSOLIDATE.*

The gentlemen who have been working up the combination of the carbon interests of this country have at last succeeded in bringing all of the manufacturers into the fold. This deal may not be an auspicious one for the future development of the electric lighting business. There will undoubtedly be an advance in the price of carbons, and this may seriously affect a number of electric lighting companies whose contracts were made on the present low price of carbon pencils. Mr. E. C. Hawks, an able young attorney of Buffalo, interested in the Buffalo Carbon Company, worked up the consolidation, and will be at its head in the future. The permanent headquarters will be at Cleveland, although manufactories will probably be continued in Pittsburgh and St. Louis. It is the intention of the new organization to improve the quality of carbons furnished consumers hereafter. The consolidation dates from April 1st, and is now in force. The price of carbons, we understand, ranges from $20 to $30 per thousand.

## *THE EARTH AS A RETURN CIRCUIT.*

The use of the earth as a return circuit for a telegraph line was first adopted in England on the Blackwall railway wires, in 1841; but Steinhill did the same thing in 1838 on his Munich line; and in 1747 William Watson, with his little two miles of telegraph over Shooter's Hill, had a rod of iron for a ground; finally, and to conclude, in 1756, Kennersley, of Boston, suggested to one Benjamin Franklin that, "as water is a conductor, as well as metals, it is to be considered whether a river, or a lake, or sea may not be made part of the circuit through which the electric fire passes, instead of a circuit all of wire." Then Steinhill was not the first, as they used to tell us—was he?

## *GLOW LAMP LIGHTING.*

The principle of getting the "most for one's money" is often but very imperfectly understood; the difficulty appears to lie in the incorrect understanding of the word "most" in this connection. The average purchaser of glow lamps is at the present time much in the position of the man who selects the largest cigar at the price. Our remarks do not apply to the purchaser of the arc lamp for indoor uses, simply because his eyes are not strong enough to take in "all that he pays for," and so the use of an obscured globe is forced upon him. But with incandescent lamps the case is different; the user not only complains that the light is not up to "his idea of electricity," but he refuses the use of ground bulbs or other means for the better diffusion of light and protection of the eye. At the recent meeting of electric light people at Philadelphia the hotel parlors were lighted by the series glow lamps of the Schuyler Electric Light Company on the local Brush arc light circuit. These lamps were of various sizes and candle power, some were clear, and some were contained in a bulb having a very delicate frosting. The comparisons, like all others, were obvious; the filaments enclosed by the clear globes, although giving more light to the square inch than the others, had a dazzling effect upon the eye, giving rise to the erroneous idea that the surrounding space was not well lighted, the same effect which one experiences on moving from a brilliantly illuminated room to a comparatively dark one, and contraction and expansion of the retina being unable to keep pace with the other movements of the eye. It was a relief to turn to the shielded light, which had the effect of far greater diffusion.

The Schuyler Company inform us that there is comparatively little demand for the frosted lamp, and they account for the demand on the cigar theory above mentioned.

The medical journals have repeatedly called attention to the wisdom of shielding the eye from intense light giving centers, and it must be remembered that although the incandescent lamps pale in the light of the arc, they are intense when compared with a gas flame, and even that is less hurtful when shielded.

## *CHROMIC COMPOUNDS FOR BATTERY SOLUTIONS.*

Much has been said and written of late on this subject, and a very general confusion exists as to the present state of the art, and the wisest course to pursue for those who wish to make their battery solution themselves from crude chemicals, and not rely on the various chromic battery fluids now on the market, but often difficult to obtain.

It is not easy to find a place so remote that bichromate of potash cannot be found in it, and this chemical, properly used, furnishes a most valuable battery depolarizing solution.

As it is often inconvenient to transport fluid about, or keep it in quantities, it is desirable to have the chemicals ready mixed in a dry form, so that only water need be added to form a battery fluid of superior properties. This is an old idea, and like many of its kind, originated, we believe, in France. Many years ago M. Chertaux manufactured and subsequently published an account of a process of mixing together bichromate of potash and sulphuric acid in such a way as to form a hard cake, to which water was simply added to form a battery fluid. Unfortunately, however, the electrical results obtained from the fluid formed in this way were so much inferior to those obtained from fluids made in the usual way, that the process was soon abandoned, though it had several times been rediscovered and put on the market as a wonderful invention.

Working in this direction in a thoroughly scientific manner, and keeping in sight the fact that in a battery, chemicals should be mixed in the proportions of their combinations, M.M. Voisen and Dormier devised a solid mixture which, according to DuMoncel, has the following formula:

$$KO, SO_3 + [7SO_3\ HO] + K_2, 2\ CrO_3$$

Translating this formula into the form in which an American chemist would have written it, it would read thus:

$$K_2\ O, SO_3 + [7\ SO_3, H_2O] + K_2\ O2Cr\ O_4.$$

Which is equal to 1 equivalent of $K_2\ Cr_2\ O_7$ bichromate of potash; 1 equivalent of $K_2\ SO_4$ sulphate of potash; 7 equivalents of $H_2\ SO_4$ sulphuric acid.

The proportions in which these chemicals must be mixed may be calculated from their atomic weights as follows:

$K_2\ Cr_2\ O_7$. Bichromate of potash.

$K_2 = 39.1 \times 2 = 78.2$
$Cr_2 = 52.5 \times 2 = 105.$
$O_7 = 16 \times 7 = 112.$
295.2

$K_2\ SO_4$ sulphate of potash.

$K_2 = 39.1 \times 2 = 78.2$
$S = 32.$
$O_4 = 16. \times 4 = 64.$
174.2

$7\ H_2\ SO_4$. Sulphuric acid.

$7\ H_2 = 7 \times 1 \times 2 = 14.$
$7\ S = 7 \times 23 = 224.$
$7\ O_4 = 7 \times 16 \times 4 = 448.$
686.

In other words, to every 295.2 parts by weight of bichromate of potash use 174.2 parts of sulphate of potash and 686 parts of sulphuric acid.

These figures may be very much simplified by reducing them to percentages as follows:

$100 : 295\ 2 :: X : 174.2$. Hence
$X = [174.2 \times 100] \div 295.2 = 59.01\ K_2\ SO_4.$
$100 : 295.2 :: X : 686$. Hence
$X = [686. \times 100] \div 295\ 2 = 232.39\ H_2\ SO_4.$

Now the proportion reads as follows:

100. parts by weight of bichromate of potash.
59.01 " " " " sulphate of potash.
232.39 " " " " sulphuric acid.

It must here be definitely understood that as commercial sulphuric acid is never anhydrous, and the bichromate and sulphate of potash both contain more or less water of crystallization, the above theoretical proportions would be slightly changed for every particular lot of chemicals employed. In practice, however, it is not necessary to work as fine as that, and the above figures may be used. In fact, the fractions may be neglected and yet the compound will be of a superior quality.

The process of making is as follows: First, heat the sulphuric acid in a porcelain kettle over a water bath nearly to boiling, then add the sulphate of potash, and stir until it is dissolved, then add the bichromate of potash (which must be pounded in a mortar until as fine as coarse sand) and stir the thick semi-fluid mass until, upon allowing it to stand undisturbed a few moments, it begins to skim over with a crackly pellicle. It is then sufficiently cooked and may be poured into shallow moulds (soup plates answer the purpose) from which it may be easily extracted. When cold it will be found a dense, close-grained mass, which must be kept in glass jars—fruit jars with air-tight covers are the best.

To make battery solution from it, take of the compound 1 part by weight and 5 parts of water. The proportions of the solid compound and water may be varied according to the use to which the battery is to be put. It is of course understood that the above proportions are intended for solution to be used in a *two fluid battery*, the negative element carbon (positive pole) to be immersed in the above fluid, and the positive element, amalgamated zinc (negative pole) to be immersed in a dilute acid solution (preferably sulphuric), separated from the other fluid by a porous cup.

According to Messrs. Voisn and Dromier the composition of the above described mixture (which they say is a compound) is as follows:

$$2\ (KO, 2\ SO_3) + 2\ (CrO_3, 2\ SO_3) + 7\ HO.$$

Translated into the American way of expressing chemical composition it would read as follows:

$$2\ (K_2O, 2\ SO_3) + 2\ (CrO_3, 2\ SO_3) + 7\ H_2O.$$

After the complete exhaustion of the battery fluid there may be found therein a double sulphate of potash and oxide of chromium *which is not an alum*, for the oxide of chromium which is set free after the action of the hydrogen on the solution is a protoxide, and not the sesquioxide, as was pointed out by M. Gay Lussac, and confirmed by M. Bollez. The beauty of this is, that as the battery fluid becomes exhausted it turns first green, and then more and more blue, without depositing violet crystals, and the carbons *are never covered with chromic compounds.*

To those who have ever had the misfortune to take care of batteries using the ordinary bi-chromate solution, this will appeal as a valuable consideration.

### *OUR CHICAGO LEITER.*

In a town not a hundred miles away they employed a new trimmer a while ago—his predecessor had graduated as an electrician—and when starting time came at night the blessed line showed an "open." Fleet sprinters went over the line, but returned empty-handed. Then one after another of the lamps was switched out, until a discovery made the trouble clear, and applied the remedy. The new electrician had made a carbon fit in the socket by wrapping it with paper! He had always done that with a tallow candle—why not with an electric light candle?

---

New Orleans has been running wide open on the gas and electric light controversy. The *Item* is doing battle for the latter, while the *States* champions the lowest bidder. The language of these journalists is not always of the new milk variety. One of the wranglers says: "The friends of the old gas monopoly wish to perpetuate the system of farthing dips, upon the sole ground that a gas burner does not cost as much per annum as an electric light." Then the party alluded to remarks that "only a year or two ago, when the old gas monopoly held the vantage ground, the electric companies claimed only the right to compete. Now the boot is on the other leg, and the electric companies having got in, turn about, in the most unblushing manner, and set up the same audacious pretense to the exclusive lighting of the city that they so vigorously and justly denounced, when set up by the gas company." At the last the electric fellows won the fight.

---

During the sessions of the National Electric Light Association in Philadelphia, a point was made in favor of high insulation, that the rebate account of a poorly-installed plant would in a short time be sufficient to make a good plant of it.

The soundness of this philosophy finds a very complete indorsement in the following figures of deductions in a single month on a well-known city plant. The figures are taken from the official proceedings of the city authorities. While it is not by any means certain that these deductions were all on account of poor insulation, it is highly probable that enough of the loss is chargeable to that account to go very far toward renewing the line with very much better conductors. By way of settling any uncertainty which might arise in the mind of the reader, it would perhaps be well to state that there is no underground wire on the lines referred to. Behold the record, which is made up of—

| | | |
|---|---|---|
| Out all night | 337 | lamps. |
| " for 1 hour | 3 | " |
| " " 1½ " | 7 | " |
| " " 2 hours | 25 | " |
| " " 2½ " | 132 | " |
| " " 3 " | 58 | " |
| " " 3½ " | 52 | " |
| " " 4 " | 62 | " |
| " " 4½ " | 79 | " |
| " " 5 " | 105 | " |
| " " 5½ " | 54 | " |
| " " 6 " | 106 | " |
| " " 6½ " | 18 | " |
| " " 7 " | 16 | " |
| " " 7½ " | 41 | " |
| " " 8 " | 29 | " |
| " all night | 7 | towers. |
| " for 2½ hours | 1 | tower. |
| " " 4 hours | 5 | towers. |
| " " 6 " | 2 | towers. |

---

Mr. G. E. Knight, for many years manager of the Wisconsin Telephone Company, at Milwaukee, resigned on the 29th ultimo, to engage in a private business undertaking. On his withdrawal Ed. was presented with a masonic emblem and a diamond pin by his late associates.

---

The Indiana legislature failed to set the telephone business back where it was by repealing the rental rate act, but the law to-day is virtually almost a dead letter. The Central Union people are so well satisfied with the status of public opinion on the subject, that they will continue to do business on the toll basis, as they have done since the passage of the law, and will increase facilities wherever such investments will pay; but they will withdraw all instruments which are not used enough to pay the expenses of maintenance.

The City Council of Indianapolis has passed a resolution authorizing the company to maintain its poles and wires as they are now, with additions as these are needed to furnish good telephone service. The people are with the telephone company, and only the regulators are unhappy.

---

The passage of the Edison company's Chicago underground ordinance was a bugbear of no mean dimensions to people who saw in the peculier wording of the ordinance a fine opportunity for the telephone and telegraph people to come in under the shelter of the electric light company, and in that way whistle the old line underground folks down the wind.

So the mayor was besieged in his official capacity, with any quantity of objections to the ordinance as passed, and especially were the points mentioned above emphasized.

The committee consisted of E. S. Waller, Geo. L. Otis, Wm. K. Nixon, A. J. Cooper, and W. Coe, for the property owners, and an attorney for the underground company.

At the next meeting of the council, the amended ordinance was adopted after the repeal of the obnoxious act. The new act prohibits the use of the space under sidewalks without the consent of property owners, and the leasing of wires or conductors; requires the conduit laid as near the sidewalk as possible, and confines the company to furnishing electricity for light and power purposes.

---

Now that some of our American railways are beginning to light up their coaches with electricity, and the associated press heralds the fact abroad in the land, let us not forget that the same thing was done over two years ago in Germany. At Frankfort-on-the-Main, in 1885, three carriages and a luggage van were so lighted by a dynamo and twenty-six accumulators—the dynamo driven by pulleys and belts from the axles of the van, while the train ran at speeds varying between 18 and 42 miles per hour. The experimenting extended over a term of six weeks, and was, of course, "perfectly satisfactory."

Other parties on the Continent have been over the same ground, but for some reason, not given to the general public, the use of batteries for lighting trains is rather sporadic than epidemic or positively contagious; and whether the train is lighted by direct dynamo power from the engine or battery, there is always something wrong with the result.

---

Secondary batteries very much object to riding on a railroad car, because of their feeble constitutions. The shaking jars their nerves and renders them unfit for the arduous duties required of them.

The breaking up of the train into fragments, at junctions and crossings, disarranges things when the current is generated by an engine and dynamo on the locomotive. When all passenger locomotives are fitted up with a dynamo and a separate engine, the balance will be easy of arrangement, and this will very likely be the final crystallization of this whole question.

---

In looking over the central plants systems of to-day we find, in addition to the style above mentioned, the Thomson-Houston, both full and half arc, in the North, South and West divisions of the city, and the Western Electric and Jenney systems on the South side. In local installations we have variety enough to satisfy the most fastidious.

---

Chicago has borne an unenviable and unjust reputation among the members of the fraternity, because the law has held a supervising check upon that form of installation which the stalwart president of the National Electric Light Association so roundly berated at Philadelphia It has been assumed that the underground scheme was a deadly noose which throttled the electric business, from tickers to twinklers, and from telegraph to telephones,

They are all getting there just the same As one of the variety singers gave it a short time ago in an encore impromptu verse, when he got a glimpse of an electric light committee from Iowa in a private box:

"They said that the conduits would ruin the biz,
And keep electricians away;
That telephone lines wouldn't work down beneath,
But up on the poles must stay.
Yet somehow or other they keep going down;
They've learned that it's business, not play;
The ground hog they find from his shadow don't run,
Because he ain't built that way."

---

The appearance of our principal streets, as contrasted with that of the thoroughfares of three or four years ago, is marked enough, and greatly improved certainly. Hitching posts are not as frequent, it is true, but those who drive—except that class of people who walk in the middle of the street when at home—have no need of hitching posts now-a-days. They anchor their animals.

---

Buffalo is all torn up on the underground question now. The Richmond Hotel fire has hastened the matter of pole line condemnation very materially. The heavy wire route, which, with the electric light lines, impeded the work of the firemen, and thus prevented without doubt the rescue of many who perished, has rung the death knell of the overhead lines in that city.

---

The Wunder & Abbott and the Badger people, running several sets of central plant circuits from their dynamo room on Fifth avenue, near Madison street, were suddenly caught in a snap the other day by the breaking down of the engine. The circuits thrown out of service comprise Ball, American, Brush and Sperry systems.

CHICAGO, April 4, 1887.

### *OUR BOSTON LETTER.*

The office of the Simplex Electrical Company, 328 Washington street, is now supplied with current from the Bumpstead Court station of 110 and 220 volts on which one to four lamps are run. The light obtained is white, without the bluish cast of arc lamps operated in series on long circuits. Four lamps in series with 220 volts give a very steady light. The problem of successfully using arc lamps on constant potential circuits has never before been successfully attacked, there being many in the electrical field who claim that it is an impossibility.

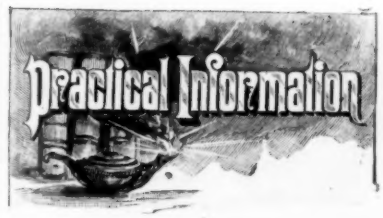
---

Ed. W. Hammer, formerly inspector for the Edison United Manufacturing Company of New York city, has been appointed general manager of the Edison Electric Illuminating Company, of Fall River.

---

The negotiations relative to an absorption of the Weston Illuminating Company of Boston by the Boston Electric Lighting Company, as was recently mentioned in the REVIEW, have resulted in the lease of the former company to the latter for a term of 999 years, with the privilege of purchase at a stated price. Possession was given to the Boston Electric Lighting Co., April 1. The Stanhope street (Weston) station will probably be abandoned, the machinery being removed in part to the Ferdinand street station (Brush), and the remainder to a new station to be built on the water front. The Congress street station (Thomson-Houston system) will be abandoned and the machinery placed in this new station, where cheap coal, direct from vessels to the furnaces, and an abundance of water for condensing purposes may be expected to prove how cheaply, under able management, electric light and power can be furnished in a large city. The Boston Electric Lighting Company has now a control of arc lighting and incandescent lighting on multiple cut-out boxes, distributors, and converters. The successful working of the conver er system has so encouraged the company that their lights in the Court House and City Hall are to be operated by this system. The main offices of the company are being moved to 17 State street.

BOSTON, Mass., April 5.




### QUERIES AND ANSWERS.

*To the Editor of Electrical Review:*

1. Do, or can, wires laid in a cable become crossed? If so, how?

2. Has the Metropolitan Telephone and Telegraph Company any wires in operation laid underground? If so, where?

INQUIRER.

ANSWER:—1. Wires in cable, if not crossed at time cable is manufactured, will not become directly crossed—through contact, we mean—unless an accident happens to the cable. Should the outside cover permit water to enter, or should a nail or piece of metal be driven in, the wires would then become "crossed" in the sense that the electric current would be carried from one to another, by means of the conducting water or foreign metal abrading and connecting the wires. A small hole in the lead covering that permitted the rain to enter, has compelled the stringing of a new telephonic cable.

2. The Metropolitan Company has been operating underground wires for two years past, at their Spring street, 21st street and 39th street exchanges. About 800 wires of the Brooks system are used at Spring street; 1,000 wires of the Edison underground system, at 21st street, and the Patterson cable at 39th street. At the present time the company is drawing the Patterson cable into the Dorsett conduit between 21st and 58th streets, on Sixth avenue, and expect soon to have these cables replace their overhead wires.

---

From the current of an induction coil, or a Holtz machine, beautiful luminous effects may be obtained by applying the ends of the conducting wires to the ends of a plate prepared as follows: Apply shellac varnish to one side of a piece of window glass, about 6 in. long and 4 in wide, and sift iron filings over the wet surface. Allow it to dry.

---

*To the Editor of Electrical Review:*

What is the cheapest kind of zinc I can obtain for batteries? CLIMAX.

ANSWER:—Sheet zinc, such as is used by tinmen and carpenters. If used in an acid battery, it needs amalgamation. Care should be taken, however, to use as little mercury as possible, or the zinc will become very britle.

---

*To the Editor of Electrical Review:*

Why is an alternating current of 1,000 volts more dangerous than a direct current of 1,000 volts? R. E. SISTANCE.

ANSWER.—It is still a question which is the more dangerous. By an alternating current of 1,000 volts is meant a current of which the mean of the squares of the volts which vary from 0 to maximum, both in a positive and negative direction. The highest electromotive force is over 1,500 volts when the average is 1,000 volts.

---

*Black Wax.*—Add one ounce of beeswax to half an ounce of Burgundy pitch, melt them together, and add one ounce and a half of ivory black, ground very fine and dried.

---

*Etching Liquid for Steel.*—Mix 1 ounce sulphate of copper, ½ ounce alum, and ½ teaspoonful of salt reduced to powder, with 1 gill of vinegar and 20 drops of nitric acid. This liquid may be used for either eating deeply into the metal or for imparting a beautiful frosted appearance to the surface, according to the time it is allowed to act. Cover the parts you wish to protect from its influence, with beeswax or tallow,

## Telephonic News

*** The bill to place all electric wires underground, introduced in the New Jersey Legislature was defeated in the House.

*** The stockholders of the Providence Telephone Company voted last week in approval of the action of the directors increasing the capital stock and entering into a perpetual franchise from the American Bell Company.

*** The annual report of the Bell Company shows an increase in telephone subscribers during the past year of 9,318. This indicates the steady increase of public appreciation of this system of communicating intelligence. In the year preceding there were not so many new telephone patrons by nearly 7,000.

*** Mr. Geo. W. Foster, formerly of Galveston, Texas, has been appointed superintendent of the Second District of the Southwestern Division of the Erie Telephone Company. This is a deserved recognition of a popular and efficient telephone man, a gentleman in every way worthy of promotion. Mr. Foster's headquarters will hereafter be at Austin, Texas.

*** Commissioner of Patents Montgomery has rendered a decision on the petition of J. W. McDonough to report the old telephone patent interference case of T. A. Edison, Elisha Gray, J. W. McDonough and Alexander Graham Bell. Without entering into the merits of the petition on motion to reopen, the Commissioner is of opinion that McDonough's assignee has a right to be heard upon the subject of vacating the award of priority made by Commissioner Butterworth, and fixed April 19 next as the day upon which all interested parties may be heard upon this question. That part of McDonough's motion asking that the order of Commissioner Butterworth be vacated the Commissioner declines to entertain.

*** The tall, good-looking young man says the *Evening Sun*, with just a tinge of gray in his black hair, frequently observed about the hotels chatting with well-known capitalists, is Mr. Theodore N. Vail, who was for several years general manager of the Bell Telephone. He went West as a telegraph operator while the Union Pacific Railroad was being constructed, and was afterwards a postal clerk. He was rapidly promoted, until he was placed at the head of the railway mail service. In Washington he attracted the attention of the Bell organizers, who were looking around for a driving young fellow to push their machine before the public, and was invited into the telephone on the ground floor, where, with the others, he became many times a millionaire. He built one of the finest residences in Boston; but he is now a New Yorker, and is devoting his energies to the development of the electrical accumulator, which he thinks is going to supplant every other known form of power.

*** The annual meeting of the American Bell Telephone Company was held in Boston last week. After the reading of the call and the minutes of the last meeting the annual report of the Directors was read. The report shows an increase of 9,318 subscribers, as against 2,969 in 1885. The company controls 14,185 miles of wire, 2,613 of which are underground. The average connections for the year are 312,605,710. The policy of extending underground wires is to be continued, involving a large outlay in the future. Terminal facilities have been secured in Philadelphia, and a long line service between that city and New York will soon be established. The line for a service between New York and Boston will be completed during the present year. The Canadian Company has increased its earnings from $158,000 last year to $190,565 this year.

The report of William R. Driver, the Treasurer, gives the following figures: Debits—Telephones, $597,749.84; stocks, $22,605,925.03; merchandise and machinery, $14,159.71; bills and accounts receivable, $1,007,872.75; cash and deposits, $683,626.55. Credits—Capital stock, $9,802,100; bills and accounts payable, $638,344.67 (of this $294,063 is the dividend of Jan 15, 1887); patent account (profit and loss), $9,373,836.07; profit and loss, $3,352,445 72; reserves, $251,227.24; surplus, $1,491,380.18. Total, $24,909,333.04. Earnings for 1886, $3,097,000, against $2,765,884 in 1885; net earnings, $1,947,283, against $1,793,196 in 1885; regular dividends in 1886, $1,176,252; extra dividends, $392,084; surplus account Dec. 31, 1886, $1,491,380, against a surplus account Dec. 31, 1885, of $1,204,120.

Both reports were adopted. It was voted to proceed to the election of a clerk, treasurer, and directors for the ensuing year. There was but one ticket in the field, as follows: Clerk—Charles Eustis Hubbard; Treasurer—William R. Driver; Directors—Francis Blake, Charles P. Bowditch, Geo. L. Bradley, Channing Clapp, Alexander Cochrane, William H. Forbes, Chas. Eustis Hubbard, Gardiner G. Hubbard, John E. Hudson, Robert B. Minturn, Charles E. Perkins, and Thomas Sanders. The above named gentlemen were elected by a practically unanimous vote, and the meeting adjourned.

### A Telephone Tangle.

The flagman at the Lumber street (Newark, N. J.) crossing of the Delaware, Lackawanna & Western railroad, saw one of the poles, carrying 100 wires, of the New York and New Jersey Telephone company swaying heavily under the weight of the wet snow and ice packed on the wires during the heavy storm several days ago. A moment later and the pole snapped off at the ground and fell across both tracks. In quick succession two other poles followed, and the track for nearly 600 feet was covered with the debris of the poles and the broken wires. Just at this instant the through freight, due at Orange at 6.05 A M., was heard above the Lincoln avenue curve, running at high speed to make up lost time. Danger flags were promptly displayed, the engineer reversed his engine and the brakemen set the brakes as tightly as possible, but the headway of the long, heavy train seemed hardly checked, and in a few seconds the engine, the Madison, struck the obstructions. Sweeping onward the wires tangled themselves about the massive machine, tearing off the head-light, smoke-stack, whistle and bell, and stripping it of all the ornamental work; and when at last the train was brought to a stand some 40,000 feet of wire was so tangled and snarled as to be useless. The damage will be in the neighborhood of $500 to the telephone company. Superintendent Wells at once put a large force at work and service was promptly restored.

### What the Central Union Will Do in Indianapolis.

Superintendent Hockett, of the Central Union Telephone Company, is reported as saying that the company intended to continue their business in Indianapolis as it had been, meaning under the toll system, with the exception that only those stations would be maintained that were fairly remunerative. Those agents who did not use their telephones enough to defray expenses would have them taken out. "Recently," said Mr. Hockett, "we have had a hundred or more requests from business men for telephone service, and they agree to guarantee that it shall be worth at least $5 a month to us. These requests come voluntarily from persons who say they must have the telephones, and it is for this reason that we asked the council to-night to allow us to put up wires to make the connections. In a general way, our policy will be to maintain stations under the toll system wherever we can do it without loss."

### Subway Matters.

The time is rapidly approaching when the work of laying the electrical subway should be resumed, but as yet no move has been made by the construction company. The promise was made when work was stopped by the frost last fall that when spring opened a large amount of work would be undertaken. If the people who are very much interested are to be believed, there has been very little done in the way of even getting ready. The Subway Commissioners are busy trying to get their official lives prolonged, and that may be a reason why there is no show of activity. The Mayor's bill to legislate the present commission out of office has been withdrawn, and a new one will be substituted some time this week. When this has been settled, one obstacle to the pushing forward of the work will have been removed.

A gentleman who is interested in subway matters says: "There is a great desire on the part of the Cities Committee in the Assembly to do something towards straightening out the subway affairs. A number of bills have been introduced, and all of them are more or less faulty. The bill that was drawn up by the Corporation Counsel at the request of Mayor Hewitt was thought most highly of, but there were many obstacles to its passage. The present Commission, although not strong enough to carry the bill continuing them in office, were strong enough to prevent the other bill from passing, and so a compromise of some kind had to be made. This has been done and the bill which will be introduced this week will provide for the continuance in office of the present Commissioners, Messrs. Gibbons, Moss and Hess, and Gen. Newton, and probably the Comptroller, will be added to their number. This will have the effect of increasing the confidence of the people generally in the character of the work, as Gen. Newton is a man who can be trusted implicitly, whether the other men are satisfactory or not, and he will undoubtedly be the leading man of the Commission.

"The effect of this bill will be to make the continuance of the contract of the Construction Company a fact, and there can be no reason for delay in the work. There should be no further delay in laying the wires, and it is time now for the commencement of the work. The different asphalt companies have been experimenting during the winter trying to find some way of making a subway, and I happen to know that they have met with very little success. Zinc tubes and paper tubes of all styles and kinds have been tried, and as yet no plan has been successful. I am of the opinion that when the time comes to give out the contract for the subway, the state of affairs will be about the same as last fall, when the Dorsett Company was the only one which was actually ready to go on with the work.

"There is great opposition among the telephone and telegraph companies who own the bulk of the Construction Company's stock, to the Dorsett Company. This is the result of some of Flynn's work when he was in the former. He had promised all sorts of things to different people and had made all sorts of constracts. One of them was with the Dorsett Company, by which he was to pay them $100,000 for the privilege of using their system in New York city. When the Telephone Company bought out the holders of the Construction Company's stock, it was assured that there were no contracts outstanding. Some time afterwards this Dorsett contract came up, and after a long argument a compromise was effected, and the Dorsett Company paid; just how much I do not know.

"From all that I have been able to gather about the work that the Dorsett Company has done, their subway has been satisfactory on the whole as far as it has gone. The expert in charge says that there are a number of defects, but that these can be easily remedied if the company lays any more conduits. As I understand, one of the difficulties was in making the joints. A number of different plans were tried with more or less success. The difficulty will be remedied in any future work. The Brooklyn method of laying a subway of creosoted wood may do very well for that city, but I feel sure that it would not work here. We want something much more lasting. I should like very much to see this bill which is to be introduced appoint an expert in subways in place of the Comptroller. It would be a very much better way of arranging things."

### The Public Telephone Station.

AN AMUSING CARICATURE OF A TELEPHONE CONVERSATION.

The industrious and talented newspaper writer has not of late been at his best in paragraphing and lampooning the telephone and "central" and other mysteries of this ever-interesting system of communication. But a recent article by Mr. Henry Guy Carleton, in the New York *Daily World*, is deserving of honorable recognition as the work of an artistic hand and fertile imagination, combined evidently with some experience. Thus sweetly sings Mr. Carleton, whose picture, it may be presumed, is indicated in the striking attitude on the left in No. 1:

'Tis sweet for kindred spirits, apart,
To hear the language of the heart.

Certainly. It was just the sweetest thing imaginable, and that is what I thought when I blessed Providence for having supplied us liberally with public telephone stations. The public telephone station is to be found in all district telegraph offices and most drug stores. It consists of a varnished box on the wall, a smaller box on the counter and a clerk who charges you 15 cents for using the thing. There is always a crank on the box on the wall. The clerk grinds this when he pretends to call up the central station. I forgot to mention this crank before. There is also a crank at the smaller box, within two minutes after you get to work. You are the crank.

CALLING "CENTRAL."

The public telephone is an inestimable blessing and should be used by all persons who are compelled to immediately communicate with some distant friend, and considering the exceedingly low rates the service is very satisfactory. [The compositor will please put *** at the end of this paragraph.]

Several days ago it became necessary for me to at once communicate with a friend who had an office downtown. In his office he has a telephone. I was on Broadway, near Wallack's Theatre. My first impulse was to telegraph him. Then I recollected having once sent a local telegram from Fourteenth street to Thirty-fourth street and it was six days and a half getting there, showing that the rate of speed on local lines is about three blocks a day.

My next thought was to get a small but vigorous boy with a pink ticket and send him with a note to my friend. Then I recollected once sending a boy on just such an errand to a point five blocks away and it took him three hours and a quarter to go and return, at a dead loss to me of three theatre tickets and one dollar and fifteen cents in cash. I ascertained later that the boy had galloped over and back to his office in fourteen minutes, had taken a nap and had a nice little game of mumble-peg with the other boys, and on his second call out, on quite another errand, had bought me my long-suffering answer and charged me for the time.

I consulted my watch. In thirty-five minutes my friend would leave his office on Broadway, near Wall. I calculated it would take a spry boy five minutes to reach the elevated road at Thirty-third street, twenty-three minutes thence to Rector street, and four minutes thence to my friend's office, giving him just three minutes to spare. I rushed into the office, and hurriedly explained the situation to the clerk. He looked at the clock, looked over his assortment of boys, consulted a time table, and shook his head. I told him I would pay the boy extra for being nimble. He said it was against the rules. Boys are only allowed to run on schedule time, I suppose.

A sudden thought struck the clerk, and he suggested the telephone. Had my friend an office? He had. What number? I did not know. He combed over a dilapidated book and said it was 91,406 Na-sau. I said it was one hundred and something Broadway. He smiled and began working the crank. The following ensued:

"Br-r-r-r-r!"

"Hello!"

A pause.

"B-r-r-r-r r-r!"

"Hello, Central! . . . Yes. . . . Ninety-one—four—ought—six, Nassau."

A pause.

"B-r-r-r-r-r-r!"

"Hello! Ye-es!—Nassau. N-a-s-s-a-u!"

Then he hung up the telephone and walked back to a desk and fired three boys for being six minutes late. Presently—

B-r-r-r-r!"

"There's your friend," he said. He turned the little box on the counter around so I could whisper to my friend. I put the telephone to my ear, and the following conversation occurred:

HELLO!

"Hello!"

"Z-z-z-t-t-t-z-z-z"——

"HELLO!"

"Uz-z-z z-splutter-z z z—click, click, click-z-z"——

"HELLO!"

"R-r-a-a-a ck-z-z hello-o-o!" (very faint).

"Who is it?"

"Z-z-z"——

"Is that you?"

"Z-z-z"——

"Speak louder."

"Br-a-a-a-a"——

"Don't get so close to the phone."

"Z-z-z"——

"Get further away!"

"Z-z z-z."

"Louder!"

"Z-z—"

"Suffering Jupiter! HELLO!"

"Hel-lo! Who-o-o? Z-z-z——"

"Is that you?"

"Z z-z-z——"

I began to feel sad. Eighteen minutes of the precious thirty-five were gone. The clerk came over and took a hand.

"WHA-AT!"

"Hello, Central!"

A pause.

"Hel-loo!"

A pause.

He gave a furious grind at the crank and evidently got Central, with whom he held an animated jug-handle conversation for five minutes. Then he passed the 'phone over to me, and said: "She was a little out of adjustment."

I assured him that it was a man I wanted, and he was usually in very good adjustments except on Saturday nights.

He said he meant the telephone.

I tried again.

"Hello!"

Ah! at last! My friend's voice, clear as a bell.

"Who is it?"

I informed him.

"Wha-at!"

I repeated my name.

"Ca-a-ant hear you!"

I spelled my name, letter by letter.

"Speak louder!"

I yelled it. At this juncture a crowd began to gather outside.

"Hello!"

I replied "Hello!"

'Who in—hello!'

I repeated my name.

"Wha-a-at!"

I spelled it again.

"Hey?"

I yelled it at the top of my lungs.

My friend was evidently beginning to suffer. I could hear articles of office furniture changing places with violence. Then he rung me up again sharply.

"B-R-R-R."

"B-r-r-r-r!"

I answered, and this message came with fearful distinctness:

"I am going out—for—a—walk—you—go—hire—a hall—snap!" and the telephone closed.

I rang him up furiously. He returned and couched his remarks in language which would not look well, except in very fine print, but the substance was an invitation for me to go to a certain place where the only merit the climate possesses is that it never changes the year round. I begged him to stay and hear me. I told him it was most important he should meet me—we would lose millions if he failed—all in vain. My only response was a hollow, mocking laugh, followed by the sound of frying, as though I were connected with the Astor House kitchen about the hour the orders for flapjacks are coming in.

The clerk then said it would be 15 cents.

I wanted to know what would be 15 cents.

A LITTLE MISUNDERSTANDING.

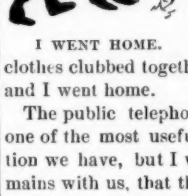
He said that was the regular price for talking through the telephone.

I said I hadn't talked half way through it.

He said that made no difference to him.

I said it made a lofty sight of difference to me.

Then we had a few words which led to a little misunderstanding. Sometimes, especially when he was on top, he would almost convince me that the tariff was exceedingly low considering the advantages of the service, and then, again, when I had a good grip on his ear with my teeth, he was nearly willing to concede I had hardly got the worth of my money. Finally, disinterested spectators in blue clothes clubbed together and reconciled us, and I went home.



I WENT HOME.

The public telephone station, I repeat, is one of the most useful adjuncts to civilization we have, but I would suggest, if it remains with us, that the company either tune up the instruments occasionally or furnish the clerks who run them with a cast-iron spring suit.

### No More "Colonels" Among Railroaders.

"It might just as well as not be understood first as last," writes Eugene Field in the Chicago *News*, "the railroad men of this country are not going to get any free puffs in the newspapers after the Inter-State Commerce bill goes into effect. As soon as the free-pass system dies, the custom of referring to Col. —— —— ——, the general passenger agent of the —— & —— Railway, as 'a talented, cultured, genial and popular official,' will fall into disrepute. There will be no genial—no, nor any cultured gentleman—in the railroad business unless they pay for their geniality and their culture at regular advertising rates. Nor will there be any colonels in the railroad profession on and after the 31st of March—at least so far as we are concerned; every man now enjoying the title of colonel by virtue of his ability to issue a free railroad pass, will be degraded to the rank of a plain mister as soon as this Inter-State Commerce bill becomes a living, breathing, sentient, desolating thing. The grinding monopolist shall be brought down to the business level of the average meek and lowly patrons who stand around our doors waiting to get into line for their turns at the advertising window. When they seek personal notices in the papers they will have to pay for them, and when we in turn find it necessary to patronize the railroads we will walk."

### *OUR PHILADELPHIA LETTER.*

There has been very little if anything done in Philadelphia during the past week in electrical work.

The Penn Electric Light Company have their station started, but are having trouble with their power. They anticipate with a few changes to be in smooth running condition in a few days and begin business with the first of their underground conduits in full operation.

A consolidation of the several arc companies of Philadelphia has been formed, forming a pool for general central station business for commercial and street lighting.

The Brush Company will operate in connection with their old station at 20th and Johnson streets, the former Thomson-Houston station, 1110 Noble street; from 200 to 300 lights will be run from this point in a short time. The Brush Company's superintendent, Mr. Fuller, and Chief Engineer, Mr. Peiffer, are now at work overhauling the steam plant (two 100 horse power boilers and a pair of 100 horse power Geo. H. Corliss engines). More power is to be introduced (probably long stroke engines, the Philadelphia Brush Company having a strong predilection that way), as this station will cover the western portion of the city north of Market street.

The United States Company on Chester street take the eastern section. The United States Company are doing considerable incandescent work on their various arc circuits by means of distribution boxes, and are to add a central station incandescent system to their present station, and do away with the distribution box system, which has not been altogether satisfactory.

Apparently the Philadelphia Edison Company are on a still hunt. They have had a number of "set backs" in their efforts to obtain a right of way for their underground work. Philadelphia is pursuing its peculiar and distinctive provincial course in this matter; a question suggests itself to me here, a conundrum, Mr. Editor, for you to answer: Are councilmen elected and sent to councils to serve the interests of the city and its people or their own and their friends'? The cause of the question is obvious.

Mr. Holbrooke, Philadelphia representative of the Schuyler Company, has contracted with the Cape May, N. J., Company for 50 Schuyler arc lights. Arc lighting at Cape May up to the present time has had a gloomy experience, simply from the fact that any power was good enough, and any wheezy old trap that would use up steam and turn a pulley could drive a dynamo. Mr. Holbrooke's experience is such that I don't think he will be caught napping by the use of poor power Cape May completes the series of watering places on the New Jersey coast, all of which are well lighted.

Long Branch claims the distinction of supporting one hundred 2,000 candle power Thomson-Houston arcs, two 50 horse power Armington & Sims engines, and two 60 horse power boilers in a well equipped station. It is operated and owned by the Thomson-Houston Company of Philadelphia. Asbury Park maintains 45 Thomson-Houston and 30 American half arcs, run from a 60 horse power Armington & Sims engine. This is a local enterprise, is well patronized and about being increased. Sanctification and piety light Ocean Grove, no power being needed.

Atlantic City is the best lighted summer resort on the coast; 200 United States and 50 Thomson-Houston lights illuminate the streets and board walks. The plant is owned and run in the interests of the gas company. Four Naylor engines are used for driving the dynamos. There is also an Edison Central station, the only one on the New Jersey coast. It has a capacity of 3,000 lamps. They are doing a very good paying business. The plant is to be increased to meet the extraordinary demand already coming in for the approaching season. Their business is entirely a commercial one. One ninety and two eighty horse power Armington & Sims engines are used to drive their dynamos.

This is a remarkably well-built and equipped station, the entire plant being erected according to the very excellent requirements of the Edison Company and under the inspection of Mr. J. H. Vail.

Cape May completes the list, and they are to be congratulated upon getting a light or power that will make a light. J.

PHILADELPHIA, April 2, 1887.

## TELEGRAPHIC

.... Gen. Gourko, Governor of Warsaw, is superintending the establishment of subterraneous telegraphic communication between all the fortresses in Russian Poland.

.... The Bear Mountain Telegraph and Telephone Company has been chartered at Bear, Ark., with R M. Luton as president. Will build a line from Hot Springs to Fort Smith, *via* Bear. The paid-up capital stock is $50,000.

.... The new catalogue (fifth edition) of W. R. Ostrander & Co., 21 and 23 Ann street, New York, has just been issued, and contains an interesting illustrated list of speaking tube and bell hangers' hardware, electric bells and supplies. This company through its factory in Brooklyn is turning out a great deal of very satisfactory work.

..... At a meeting of the stockholders of the Monumental Underground Telegraph Pipe Company, held at the office of the company, 209 North Liberty street, Baltimore, Thos. R. Rich, A. Worth Spates, James W. Denny, W. D. Rich and Wilbur F. Sadler were elected directors for the year 1887. They elected the following officers: Thomas R. Rich, president; A. Worth Spates, secretary, and James W. Denny, attorney.

..... Thomas O'Reilly, of New York, Master Workman of the Telegraphers' National Trade District Assembly No. 45, of the Knights of Labor, in a recent interview is reported as follows: "We now have 8,000 members enrolled in our assembly. It was formed only last June, you know, and we have made no efforts to get members of the craft to join us. Our membership comprises the cream of the profession. Instead of taking in everybody and trying to discipline them afterwards, and finding that we are an undisciplined army, as we did in 1883, we are building from the foundation upward and educating our members thoroughly as we go along. Our prime object is to induce the National Government to take possession of the telegraph lines of the country."

.... Justus Mensbing and Victor Meyer have determined the vapor density of zinc, using the porcelain apparatus described by V. and C. Meyer in a furnace capable of producing a temperature about 1,400° C. The apparatus was filled with pure nitrogen, and the vaporization of the zinc took place quickly and regularly. In one experiment, in which the temperature was not raised to the full power of the furnace, the density found was 2.41; in another, conducted at the highest attainable temperature, the density was 2.36. These figures assign the value Zn for the molecular formula of zinc vapor; theory would require the number 2.25. The three metals, whose vapor densities have been determined (mercury, cadmium and zinc) have, in the gaseous state, molecules containing but a single atom.

.... It has been the fashion these last few years to cry "underground," as the magic word which could solve the questions of methods of distributing light, heat, power, milk, water—not excepting conversation. Underground railroads, pneumatic tubes and the like, are spoken of as annihilating distance. Politicians have long laid pipes and wires, which, for freedom from induction, leakage, cross-talk and the like, leave much to be desired by the patriotic citizen. But we may go too far. The Romans found by experience the superiority of aqueducts for carrying large amounts of water; and we, with all our improvements in pipes and pipe manufacture, are using them more and more. The plan of placing cables of wires on elevated railroad structures has been tried, and found successful. Repairs are easily made, and old cables replaced by new. Danger from breakage or leaks is reduced to a minimum.

## ELECTRICAL AND SCIENTIFIC

* * Acetylene is the lightest liquid known and is a little less than one-half as heavy as water.

**The temperature of the external envelope of the Bunsen burner is 1,350 degrees Fah.; the violet portion, 1,250 degrees; the blue, 1,200 degrees.

* * The work performed by the human body in a day in circulating the blood, in breathing, and in other processes, is equal to that of 22 horse power for one minute, or sufficient to light a 3 candle incandescent lamp continuously. This may account for the quotation of some envious persons, "Can't hold a candle."

* *The passage of the Inter-State Commerce bill is already felt in electrical circles. A few days ago the L. L & O. W. Railroad Company informed our friend Browser that they would have to charge additional for return freight on his storage batteries sent the city to be charged. On remonstrating with the officials he was kindly informed that the batteries on their return were filled with electricity.

* * Prof. McGee, of the Geological Survey, in a recent lecture on the Charleston earthquake, said that displacement is now in progress at a rate so astonishingly rapid as to occasion surprise that earthquakes are not more frequent, and the cities of Pittsburgh, Richmond, Fredericksburg, Washington, Baltimore, Port Deposit, Wilmington, Philadelphia, Trenton and New York have been located on the very line of displacement.

** A set of small drawers for work shop use that will hold powders, or even liquids, is useful. Obtain from the hotels a number of sardine boxes. Lay the box top downward on the stove, and when the solder begins to melt lift the box and the ragged remains of the cover will fall off. After cleaning out the oily deposit, put in each box a facing of wood, a little larger than the end, and screw a little knob to this from the point, punching the hole through the tin by an awl. A rack to hold them is easily made, as they are all of the same size.

* * Efforts are being made to form a company to develop the invention (?) of a roller contact make and break. The projectors assume that not more than two motors can be run in parallel from the same source of electric current. The make and break wheels are to be placed on each car, the current being supposed to go to the more distant motors when those nearer the dynamo are cut out of circuit. So rapid are the intervals when the motors receive current that they are supposed to move as if they received current all the time. The entire plant of the company consists of a wooden cylinder 3 inches diameter, 1 inch thick, alternate spaces on which are painted black. Verily Goldsmith should have traveled over Europe on the strength of a paper collar and a sulphur match, had he wished to maintain his prior rights as a do-much with do-little.

* * A small hand Gramme series dynamo was connected up to a voltameter, but however quickly it was rotated no electrolysis took place until the electrodes of the voltameter were conected by a resistance of a few ohms, or short circuited by a piece of wire. The reason is that in the first instance the difference of potential at the terminals of the voltameter was less than 1.14 volt, too little to send any current through the circuit, and the field-magnets of the dynamo were therefore unexcited: as soon as a by-pass was provided, part of the current flowed through it, and the field-magnets being excited, the difference of potential rose above 1.14 volt and electrolysis commenced. If now the by-pass was interrupted and the dynamo still worked, the current passed entirely through the voltameter, but as soon as the speed was at all slackened the current ceased, and it was impossible to start it again without reconnecting the by-pass.

### The Simplex Arc Lamp.

There is to be seen in the rooms of the New York Electrical Construction Company, 145 Broadway, the novel sight of an arc lamp burning on an incandescent circuit. The Construction Company is the agent for the lamp which is an English invention, and is called the Simplex lamp. It possesses a delicate and simple feed, the current passing through a solenoid at top of the lamp. Each arc lamp takes the current used in about eight incandescent lamps, and gives a brilliant and effective arc light. The lamp has been put on a number of incandescent circuits in Boston, and arrangements are being made to use several of them in New York, where the strong light of a single arc is occasionally or regularly required in connection with an incandescent plant already installed.

### Cars Safely Heated and Lighted.

The Boston express train that rolled into the Forty-second street station at 10½ last evening (March 30) pounded over the same rails that bear hundreds of trains daily, yet it was as much of a pioneer in its way, says the New York *Sun*, as was Peter Cooper's little locomotive. With all the progress and improvement in rolling stock since that successful experiment, a very conservative policy has governed the arrangements for heating and lighting cars. This train, however, the latest production of the Boston & Albany railroad shops at Allston, was lighted by electricity and heated by steam.

For the first time in the history of railroading the world over, a complete train so lighted and so heated has been successfully run. President Bliss and General Manager Barnes take no little pride in the fact that they have made this record, and are convinced that they have set the pace that all must follow.

The train was on a regular run, leaving Boston at 4½ P. M., and it is there to stay. A few weeks will see its mate, which sets out from New York at the same hour, similarly equipped. As fast as possible all the rolling stock will be so arranged. Other railroad managers, who have been looking on with great interest, and with equal patience, while the Boston and Albany have experimented, will then have an opportunity of following the new example.

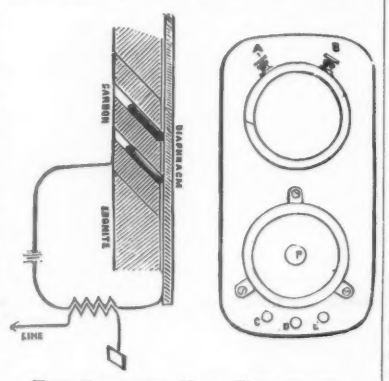
The cars themselves are worthy of description, though fine woodwork and cabinet finish are not novelties. The baggage car, smoker, two passenger coaches, and two drawing-room cars all have the Roman arch roof, which gives an imposing exterior and interior effect. The dark mahogany finish that is uniform in the passenger cars would be, in the gloom of ordinary kerosene oil lamp lighting, too somber. But there is no oil burning except in the headlight, and the twenty incandescent electric lamps that are ranged in double rows along the high ceiling of the cars effectively light up the beautiful markings of the natural wood. Each light is of sixteen candle power, and the steady glow is fed from the storage batteries of the Julien system. Newspapers may be read with ease, and the cars are cheerful and pleasant. There are sixty storage cells to each car placed under the floor between the trucks, and they may be charged with electricity while the train is laid up on a side track in Boston. They will hold twelve hours' supply of the electric fluid, so as to make the round trip to New York and return, and with time to spare.

The steam heating device is what is known as the Martin system, and consists of an arrangement of pipes which take live dry steam from the dome of the locomotive and conduct it through the cars so as to distribute the heat thoroughly. The distinctive features of the system are an automatic pressure regulating valve on the engine, and controlling valves for each car from a main pipe below the car, so that the different cars may be kept at varying temperatures. The water of condensation is carried off by an automatic drip and does not return to the boiler. The live dry steam is thus enabled to do its perfect work.

George W. Blodgett, the electrical engineer of the B. and A., and Charles H. Barnes, of the Superintendent's office, ran the train through to instruct the train hands, and will take it back.

### The New Telephone.

The scientific world was startled last week by an announcement which appeared in the London *Times*, on the 9th inst., and which, as regards lucidity of explanation and scientific accuracy, leaves even more to be desired than is generally the case when technical or scientific matters are taken up by daily papers. The announcement referred to a new "micro telephone push button," which has been tried in connection with the Paris-Brussels line. The feats performed by this instrument so astounded the correspondent of our contemporary, that he telegraphed a most glowing account of this wonderful new invention, which, in his estimation, seemed to have all the advantages of the best telephones, with the additional merit of costing only half a crown. It is needless to say that if all the claims were realized in practice, a complete revolution would take place in telephony, but unfortunately this is not the case. We had, last week, an opportunity of inspecting one of these telephones, and upon taking it to pieces we found that it contains all the essential parts of an ordinary telephone transmitter and receiver; but these parts are very small, and are packed closely together, thus securing a very compact arrangement. It is probably owing to the small size of the apparatus, and to the apparent simplicity, when only the outer case is contemplated, that the correspondent of our contemporary became imbued with the idea that the new telephone is so simple, and can be made for half a crown. The external




THE CORNELIUS HERZ TELEPHONE.

appearance of this telephone is illustrated in front view. On a board, measuring about 5 in. by 10 in., is fixed a call bell *I*, to the terminals *A B* of which wires are brought on the back of the board from the telephone proper, which is placed just underneath; *C D E* are the terminals serving for the line and battery wires, one of them being common to line and battery. The transmitter is contained in a metal box screwed to the board; and the telephone receiver is fitted over with a bayonet joint, and is removed when the instrument is used for speaking. The central button P serves for the call, and when pushed it rings a call bell at the other station. When the receiver is placed over the transmitter, one of the pins of the bayonet joint presses back a spring, thereby breaking connection with the microphone, and establishing connection with the bell circuit. In this condition the instrument is ready to receive a call from the other station, or to transmit one. Upon removing the telephone receiver from the transmitter, the spring recedes, the connections are charged, and the latter is now in circuit with the battery and the primary of a pair of induction coils. In this condition the instrument is ready for speech.

The connections are clearly shown in our sketch, and are as follows: In the primary circuit, from one pole of the battery to the carbon block, and from the other pole of the battery, through the primary of a pair of induction coils, to the diaphragm. The secondary of the pair of coils is coupled to line and earth, or to a metallic return, if desired. The carbon block is held in a disk of ebonite, of the same diameter as the diaphragm; and the induction coils, as well as the different springs and contacts, are all placed behind the diaphragm. Experiments made with this instrument at the post-office, between two rooms, have proved that speech is transmitted with good results, but that the volume of sound is only about a fourth part of that of the Gower-Bell instrument. The speaking battery consisted of two Leclanche cells. The inventor, Dr. C. Herz, of Paris, intends to make the arrangement of this telephone still more compact, by placing the call bell below the transmitter, so that the bell, transmitter and receiver will practically be in one piece, and may be fastened to a board not more than four or five inches square.—*Industries.*

### PERSONAL NOTES.

There promises to be a large attendance of representative electrical people at the Electric Club anniversary, April 21st.

Mr. S. B. Richards, of Philadelphia, representing the Solar Carbon Company, of Pittsburgh—a carbon manufactured entirely from natural gas—and Mr. W. J. Buckly, of Chicago, representing the Ft. Wayne Jenney Company, were recent New York visitors.

Mr. Geo. F. Porter is one of the most active and enthusiastic members of the Electric Club, and much of its pronounced success is due his earnest efforts. As a member of the Pittsburgh Carbon Company, he is ever welcome in electric lighting circles, where he has a wide circle of friends.

Among the particularly successful telephone men must be classed Mr. H. P. Frost, the general manager of the Southern New England. He probably has a stock interest in more telephone companies than any general manager in the country, and possesses an abiding faith in the continued growth of the telephone business.

Mr. George T. Manson, formerly purchasing agent of the New England Telephone Company, is succeeding finely since coming to New York and accepting a responsible position with the Okonite Company. There is a growth and extent to the general electrical business that makes it very attractive for capable and progressive young men.

Mr. Zack Latshaw, of McKeesport, Pa., was a New York visitor last week investigating storage batteries. His electric light company is doing quite an electrical business, including several branches, and has a manufacturing territory that makes the demand a very extensive one. Much of the success of the company is due to the energy of Mr. Latshaw.

Mr. E. L. Smith, at one time prominently identified with the telegraph and telephone interests of Missouri and Kansas, is now a deserter, and is gaining flesh and shekels as treasurer and director of the National Loan and Trust Company, of Topeka, Kan., one of the strongest financial institutions in the State. While regretting his departure from electrical circles, his numerous friends will ever wish him all the good things of earth.

Mr. H. C. Adams has tendered his resignation as representative in New York of the Messrs. Holmes, Booth & Haydens. Mr. Adams will probably continue in the wire business, with which he is quite familiar, and may also increase his interest in electric lighting. Mr. Thomas L. Scovill, well known in manufacturing circles, and formerly with the Scovill Manufacturing Company, has accepted the general agency of the H. B. & H. Company in New York. We bespeak for him a most kindly welcome from electrical people.

Mr. John W. Beane, for several years prominently identified with the New York Dock Department, and prior to that time an officer in the U. S. Navy, has devoted his energies and talent with gratifying success to the broad field of electric lighting during the past year, taking general charge of the New York business of the Mather Electric Company. About a dozen plants is an excellent record for one year, in a field where competition is so entertainingly lively.

Mr. Geo. F. Parmelee, president of the Edison Illuminating Company, of Topeka, Kan., is in New York negotiating with the parent company for a large increase of plant, to include dynamos and Sprague motors. The station in Topeka, with a capacity of 2,400 lights, was started 60 days ago, and already the demand has compelled an increase. The substantial growth of this beautiful city on the prairies has proven the correctness of Mr. Parmelee's faith. The majority of the new residences and business houses are wired for the incandescent light, after the manner of Eastern cities, and the motors are being generally adopted in all places requiring power.

## Report on the Adaptation of the Electric Light to Light-House Illumination.

By Lieut. John Millis, U. S. N.

I have the honor to submit the following report of progress in experimental work relating to the adaptation of the electric light to light-house illumination, up to June 30, 1886, the preparation of an earlier report having been prevented by other duties upon which I have been engaged under the direction of the Light-House Board.

Before explaining the nature and object of the experiments which have been conducted during the year, it will be necessary to state first the reasons which appear to have prevented the adoption in our service of electric lighting apparatus of the pattern now being introduced, to a considerable extent, in the light-houses of foreign countries. The principal objections to the adoption of the new light in its present form are the expense of installation and the increased cost of maintenance. With very few exceptions, the frame-work of the lanterns of our first-order light-houses are built with vertical and continuous ribs, and in all the lenses now in use the brass framing is also made with vertical bars. This mode of construction renders it impossible to produce uniform illumination over the entire sea horizon, since each vertical rib interrupts a portion of the light throughout the whole height of the lens, diminishing the intensity of the beam emitted, and shortening the range of visibility over certain portions of the horizon, while between the ribs the light shows with full power. This objection is not serious in case of a flash light, owing to the greater width of the beam thrown by the large flash panels of the lens; but for a fixed electric light, where the emergent beam is very narrow, it is a fatal defect, and for such a light the lantern and lens must be built with inclined or helical ribs, to secure a uniform distribution of the light, and to avoid the "dark angles" which would be produced by vertical ribs.

The complete set of electric light-house apparatus which was procured from abroad for trial by the Light-House Board, is designed for a fixed light, and its installation for continuous use at an established light-station would require the rebuilding of the lantern, the erection of a structure from which to exhibit a temporary light while the change was in progress, and the final abandonment of the costly optical apparatus now in use. It has therefore not yet been deemed expedient to undertake the immediate change from oil to electric illumination, with the apparatus in its present state of development.

The foregoing considerations will render evident the advantages which, for the present at least, and until the complete reliability of the new light under the keeper's management shall be established, would be offered by an electric light which, while being greatly superior in intensity to the oil lamp, would at the same time be adapted for use in its place without alteration of the lantern or lens, and which would admit of ready removal, if necessary, and the replacement of the oil lamp. Such a lamp it has been sought to devise. The principles involved in the construction of an incandescent electric lamp adapted for this purpose, and designed so as to give the maximum amount of illumination in the most efficient direction, were fully explained in my last annual report During the year a number of such lamps have been constructed. In the progress of this work many serious difficulties not anticipated from the performance of smaller lamps were encountered; but a practicable lamp, much superior in luminous intensity and compactness to the first-order oil flame, has been produced. But the extreme limit of practicable luminous intensity has not yet passed 1,000 candle power, and although the greater compactness of the light source in the new lamp renders its superiority over the oil light for use in the lens much greater than the mere comparison of candle power would indicate, a satisfactory luminous intensity, justifying the establishment of a steam plant to produce it, has not yet been attained, although there is continued progress in this respect.

Regarding the superiority of the arc electric light over all other modes of illumination yet developed for primary sea-coast lights, there can no longer be any question. This fact was definitely established by the very exhaustive experiments made at South Foreland, England, by a committee of the Trinity House, as stated in their report of August, 1885; and it is further sustained by the increasing number of electric light-houses in actual operation and the favor with which they are received by mariners.

According to the information received from the United States branch hydrographic office in New York, the light-houses now illuminated by the electric light are as follows:

In Mexico, 1; Brazil, 1; Australia, 1; Egypt, 1; on Sea of Azov, 2; Italy, 1; Portugal, 1; France, 10; England, 7, including one light-vessel at the mouth of the Mersey River; total, 25.

The Hydrographic Office is also informed that the electric light is shortly to be introduced at the Isle of May light, Scotland.

It is evident that with the present known means of generating electricity it can never compete with oil as an illuminant in the matter of expense, if the comparison be made with the present annual cost of maintaining a first-order light, without regard to the greatly superior intensity of the electric light, and that, as stated in the report of the committee of the Trinity House previously referred to, electric illumination, as at present developed, is only to be recommended for the more important coast lights, in which cases it is by far the best available agent for producing such a light as the situation demands.

In this connection it should be remarked that the general illumination of a channel-way like that of Hell Gate, New York Harbor, by means of a powerful light placed near at hand, and the production of a high-power light as a beacon on the coast, to be directly visible from great distances at sea, are entirely different problems, and the adaptability of any mode of illumination to the second case is not to be determined from the effect produced when it is applied as in the first instance.

Experiments directed to the devising of an electric lamp which can be used in the present optical apparatus are still in progress, this being the most promising method of increasing the efficiency of important primary lights, next to the adoption at once of a complete outfit of electrical and optical apparatus suited to the purpose, which is now obtainable.

—— The New Haven *Real Estate Record* has the following: "The sale of property on Winchester avenue, which was formerly the Judson Bros.' packing house, to the American Electric Manufacturing Company, of New York, has at length been consummated. The sale was announced some seven months ago, but owing to some formalities which had to be passed through in New York, the actual sale has just taken place, and the deeds were recorded last week. The property consists of the large four-story brick building on the west side of Winchester avenue, erected in 1875 by Judson Bros., afterwards the Judson Brothers' Packing and Provision Company. The property was heavily mortgaged to the Chelsea Savings Bank, which foreclosed, and has been in possession until now. The deeds were made out in the name of Edwards H. Goff, the president of the company, whose headquarters are at No. 146 Broadway, New York. The company manufactures the dynamos, electric lamps, etc., used in the Fuller-Wood system of electric lighting. The manufacturing department of the concern will be transferred to New Haven, and operations begun at once. About two hundred hands will be employed. This will make an important addition to the manufacturing interests of New Haven, and will have the effect of increasing still further the activity in building and real estate which has existed in that part of the city for some time past." The price paid was between $17,000 and $18,000.

### New Engineering Office.

The Jarvis Engineering Company, of Boston, have opened an office in this city at 109 Liberty street. Mr. J. N. Pratt, well known in engineering circles in New England, has charge. The Jarvis furnace and high speed engines, for electric lighting, will be brought to the front in new fields in the most promising manner.

### Verdict on the Buffalo Hotel Fire.

The verdict of the coroner's jury investigating the Buffalo hotel fire says that the electric wires and cable proved of great danger to life, impeding the efforts of the firemen, and recommends that the city authorities take immediate action for their removal. It also says that the means of escape were entirely deficient, there being only one fire escape in the building, and censures the Chief Engineer of the Fire Department and the Fire Commissioners for not enforcing strict compliance with the law, and the hotel proprietor for neglect of duty.

### A New Appliance for Controlling the Electric Current.

Mr. E. R. Knowles, superintendent and electrician of the Mutual Electric Manufacturing Company, of Brooklyn, has recently constructed an automatic appliance to be used in controlling the arc current for the purpose of charging electrical accumulators. It is so arranged that the batteries can be charged for any number of hours desired, and the instant the time set has expired the current is automatically switched off, and the batteries thrown to the incandescent line ready for use. The mechanism is quite effective and ingenious.

### Bids for Lighting the City of New York.

The Gas Commission, consisting of Mayor Hewitt, Comptroller Loew, and Commissioner Newton, opened bids for lighting the city with gas and electric light for one year from May 1, prox. The following were the bids:

Harlem Electric Light Company, for lights of 2,000 candle power, 70 cents per light per night on Mount Morris tower and Harlem bridge, and 48 cents per light elsewhere.

United States Illuminating Company, electric lights of 1,000 candle power, 65 cents per light per night.

Brush Electric Illuminating Company, lights of 2,000 candle power, 65 cents per light.

North New York Lighting Company, 55 cents per light per night.

Consolidated Gas Company, $17.50 per lamp per year.

New York Mutual Gas Light Company, $17.50 per lamp per year.

Equitable Gas Light Company, $12 per lamp per year.

Central Gas Light Company, $28 per lamp per year.

Northern Gas Light Company, $30 per lamp per year.

Yonkers Gas Light Company, $30 per lamp per year.

New York and New Jersey Globe Gas Light Company, $25 per lamp per year.

The Brush and the United States Electric Light Companies receive under their present contract 70 cents per light, such as they bid 48 cents for the coming year.

Mayor Hewitt questioned the representatives of the gas companies closely, drawing out the fact that the city does not receive the benefit of the legislative reduction of the price of gas.

In consequence of the desire of the East River Electric Light Company to bid against the Brush and United States Companies the awards for electric lighting were postponed. Awards were made to the Equitable, the Consolidated, the Mutual, and Central Gas Companies for gas according to the bids.

—— Mr. F. E. Pettingill, formerly representing the Boulton Carbon Company, will in future be connected with the Cleveland Electric Motor Company, the manufacturers of the Stockwell electric motors. Mr. Pettingill has a wide circle of acquaintances in the electrical field.

## ELECTRIC LIGHT NEWS

—— An electric light plant will be erected at Gainesville, Texas.

—— The Chicago council has authorized the Western Edison Electric Light Company to lay its wires in the streets and furnish the people with lamps.

—— The Citizens' Electric Light Company, Braddocks, Pa., has sold its charter and ordinance to the gas company of that city, which will hereafter furnish both illuminants.

—— The Union Electric Light and Manufacturing Company, of Rahway, has filed a certificate of incorporation. The incorporators named are Ezra A. Carman, Joseph T. Mead and William Carman. The stock is divided into 2,000 shares of $50 each.

—— The New York Lighting Company has filed its certificate of incorporation. Its capital stock is $150,000, and its objects are the manufacture and use of electricity for light, heat and power. The corporators are Heman Clark, Thornton N. Motley, Michael H. Cardozo and Charles J. Fiske, who, with Jordan L. Mott, Jr., are also trustees.

—— The Parkersburg Electric Light and Power Company, Parkersburg, W. Va., recently reported as increasing their capital stock, have purchased a site, 60 by 170 feet, and machinery for their plant. They have adopted the Westinghouse system. Mr. E. H. Wells is secretary of the Parkersburg company.

—— The Brush Electric Light Company, of Chattanooga, Tenn., have bought a lot near East Tennessee, Virginia and Georgia Railroad in the city, and will soon erect a first-class station, putting in two Ball engines of 80 horse power each. Have bought twenty new lamps, and propose to push the electric light business to its fullest extent. The superintendent is Mr. S. C. Dodge.

—— Mr. Chas. A. Schieren has assumed the entire business of the well-known belting company, Mr. Jacob R. Stine retiring. Mr. F. A. M. Burrell will be connected with the house as formerly, and the firm-name of Chas. A. Schieren & Co. will remain unchanged. Messrs. Schieren and Burrell are greatly pleased with the extensive patronage their electric leather belt has met with among electric light men, where it is quite popular.

—— The McKeesport Electric Light Company, of McKeesport, Pa.—Mr. Zack Latshaw, general manager—has contracted with the National Tube Works, of that city, to put in 250 arc lights and 1,000 incandescent, in addition to the plant of 60 arcs and 500 incandescent lamps already in use by the Tube Works. This company has very extensive works, has thirty acres covered by buildings alone, and 8,000 men employed, and so thoroughly is the electric light appreciated that the large order for an increase mentioned above has been given.

—— Groups of people gathered last evening, says the *Tribune* of the 31st, along One Hundred and Twenty-fifth street and Third avenue, to witness the lighting of the streets. The Harlem Democratic Club, since its organization in 1881, has been an active champion of the cause. It has succeeded in inducing the Harlem Electric Lighting Company (Waterhouse system) to stretch its wires along Third avenue and One Hundred and Twenty-fifth street, and to agree to light those thoroughfares free for ninety days. The club held its regular weekly meeting at the club house, No. 59 East One Hundred and Twenty-fifth street. Speeches were made by A. L. Soulard, Charles W. Dayton and the president of the club, Major J. R. McNulty. Major McNulty reviewed the work of the club and its efforts to obtain proper lighting facilities for Harlem and Mount Morris Park, and then turned to a small electrical appliance on the wall behind him, and, turning a switch, turned on a hundred electric lights along One Hundred and Twenty-fifth street and Third avenue.

# ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MARCH 29, 1887.

359,990 Railway car telegraphy; John A. Barrett, New York, N. Y., assignor to the Railway Telegraph Company, same place.

359,999 Watchman's time recorder; Edward J. Colley, Chicago, Ill.

360,002 Reflector for electric lights; William W. Downing and Artemus B. Upham, Peoria, Ill., said Upham assignor to said Downing.

360,024 Galvanic battery solution; William P. Kookogey, New York, N. Y.

360,025 Electric signal system; Carvosso Lambdin, Wilmington, N. C.

360,030 Armature for dynamo-electric machines; Wm. A. Leipner, Lynn, Mass., assignor of one-half to Walter Robert Johnston, Sherbrooke, Canada.

360,040 Apparatus for suspending electric lights; George P. Nichols and Moses Coombs, Jr., Youngstown, Ohio.

360,060 Electric car brake; Elmer A. Sperry, Chicago, Ill.

360,068 Telephone; Henry E. Waite, New York, N. Y., assignor to Charles F. Livermore, trustee, same place.

360,078 Primary electric clock; John J. Abell and Clarence B. Gifford, Colesburg, Ky.

360,092 Secondary electric clock; Wirt B. Harvey, Memphis, Tenn.

360,122 System of electric distribution; Elihu Thomson, Lynn, Mass, assignor to the Thomson-Houston Electric Company, of Connecticut.

360,123 Electro-magnetic cut-off; 360,124, Automatic cut-off; and 360,125, System of electric distribution; Elihu Thomson, Lynn, Mass.

360,127 Electric sole; Francis B. Wallis, Everett, Mass.

360,144 Electric furnace; Eugene H. Cowles and Alfred H. Cowles, Cleveland, Ohio.

360,151 Electric arc lamp; Luther Hanson, Halifax, county of York, England.

360,158 Galvanic battery; Paul Joblochkoff, Paris, France.

360,175 Electric railway signal; Joseph McM. Scott, Allegheny, Pa.

360,179 Power brake; Renaldo Solano, Brooklyn, N. Y., assignor of two-thirds to John W. Howard and David R. Morse, both of same place.

360,198 Induction coil; Otto T. Blathy, Buda-Pesth, Austria-Hungary.

360,216 Electric motor; Frank E. Fisher, Detroit, Mich.

360,223 Electrical apparatus for heating and cooling buildings; Edward H. Johnson, New York, N. Y.

360,244 Electric lamp and socket; Charles G. Perkins, Hartford, Ct.

360,252 Lamp-post and signal; William C. Smith, New Haven, Ct., assignor of one-half to James P. Brewer, same place.

360,254 Electric arc lamp; John Tregoning, Hartford, Ct.

360,258 and 360,259 Dynamo-electric machine; Henry E. Walter, Clifton, and Charles Batchelor, New York, N. Y.

360,266 Annunciator and shunt circuit therefor; John A. Barrett, Brooklyn, N. Y.

360,308 Electro-acoustic apparatus; A. A. Knudson, Brooklyn, N. Y.

360,316 Conduit for underground conductors; Hans Loesner and Michel de Bravura, New York, N. Y.

360,354 Insulator; Willie F. Locke, Concord, N. H., assignor of one-half to John E. Robertson, same place.

360,375 Automatic electric circuit controller; Thos. B. Conant, Brooklyn, N. Y., assignor to the Electrical Accumulator Company, of New York.

360,377 Electric arc lamp; Walter A. Crowdus and Henry M. Sutton, Dallas, Texas.

360,381 Electric indicator; Frederick Fitch, New York, N. Y.


**BUSINESS NOTICE.**

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St., New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer*.

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